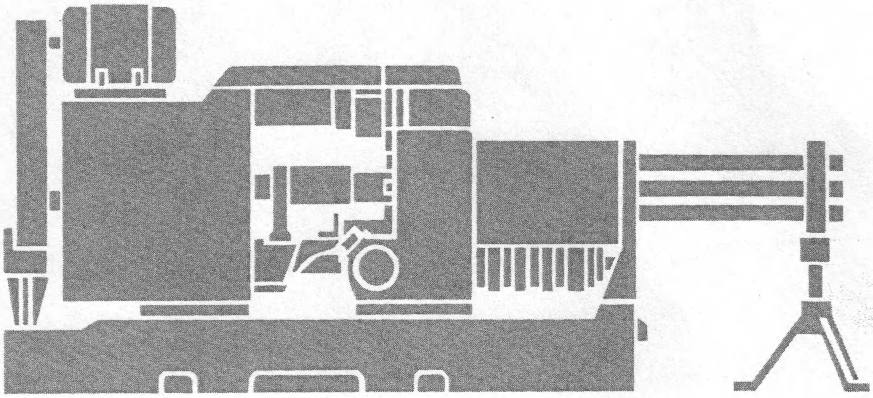
Handbook for Operators

Acme-Gridley® Multiple Spindle Bar Machines



SALES OFFICES:

NEW YORK:
One Mack Centre Drive
Paramus, New Jersey 07652
(201) 261-4940

DETROIT:
999 West Big Beaver Road
Troy, Michigan 48084
(313) 362-4140

CHICAGO:
1400 East Touhy Avenue
Suite G-1
Des Plaines, Illinois 60018
(312) 635-6555

PRICE: $25.00

NATIONAL ACME
AN ACME-CLEVELAND COMPANY
ALWAYS THINKING PRODUCTIVITY

NATIONAL ACME • 170 East 131st Street • Cleveland, Ohio 44108 • U.S.A. • Phone: (216) 268-4200

OH-80

© Copyright 1980 National Acme Division Acme-Cleveland Corporation

Printed in U.S.A.

INTRODUCTION

National Acme is pleased to present this all-new *Handbook for Operators of Acme-Gridley Multiple Spindle Bar Machines* for the novice as well as the experienced operator. Both will find it useful in obtaining a full understanding of how to utilize all of the production capabilities built into an Acme-Gridley bar machine.

The manual is designed to acquaint the operator with what an Acme-Gridley bar machine is; what it does; how it works; how it is set up; how it is operated; and how it is lubricated, cleaned and maintained. Special emphasis is placed throughout the manual on how to maintain personal safety at all times while carrying out the work for which these machines are intended. An added feature is the comprehensive troubleshooting section which also stresses personal safety in applying recommended procedures in locating and correcting faults that interfere with correct machine operation.

If problems should arise that are not covered in this manual, contact the National Acme Sales and Service Department which stands ready to assist at all times.

Now, before we move into the detailed sections of the manual, let's take an overall look at what an Acme-Gridley bar machine actually is. Basically, it is a four-, six-, or eight-spindle lathe whose work spindles support bars of metal which are fed out to working length, revolved and automatically indexed from position to position in circular increments of 90° (four-spindle model), 60° (six-spindle model), or 45° (eight-spindle model) at the completion of the longest machining operation on a work piece. The time to complete the longest operation and to index the work piece to the next position is called the machine cycle time. As you will learn, one of the major advantages of a multiple spindle bar machine is the ability to divide the longest machining operation between two or more spindles in order to reduce the machine cycle time.

When an Acme-Gridley bar machine is fully loaded and in operation, end-working and cross-working tools are advanced and retracted by mechanical cams to perform simultaneously a wide range of machining operations, such as turning, forming, milling, drilling, threading, reaming, and slotting on the work pieces in various spindle positions. When the machine indexes or completes the cycle, a finished part, or one on which as many machining operations as possible have been performed, is dropped into the tote box. Some Acme-Gridley bar machines have cycle times of less than a second!

Once called "screw machines" because of the nature of product produced, they are now called "bar machines," a better designation which refers to the type and shape of stock used by these machines to produce many thousands of different items. Bar stock is generally available in lengths of up to 20 feet having square, round, hexagonal, or other regular polygonal cross section. It is available in steel, brass, aluminum, bronze, stainless steel, and various other ferrous and nonferrous alloys. Acme-Gridley multiple spindle bar machines are available with four spindles ranging to 8" diameter, six spindles ranging to 6" diameter and eight spindles ranging to 4" diameter.

Acme-Gridley bar machines employ rigid box-type frames to provide the rugged foundation upon which to locate various other machine elements. The frames consist of four high-grade alloy castings: a one-piece, heavily-ribbed base (pan); generously cross-walled and reinforced gearbox and headstock sections; and a one-piece top plate. These castings are finish machined, carefully aligned, bolted and then doweled to form a massive structure capable of withstanding or absorbing vibration under heavy cutting strains and high spindle speeds to insure that speed and accuracy are maintained under all normal operating conditions.

The "heart" of an Acme-Gridley bar machine is the spindle carrier where the most advanced engineering and precision manufacturing methods are used to assure permanent alignment of tools with the work spindles so that precision work with fine finish can be produced at high production rates. The spindle carrier, with its precision ground work spindles mounted in antifriction bearings, indexes in the headstock frame where it is supported by two wide spindle carrier journals and a third bearing provided in the gearbox to support the stem end. Because of the basic integral carrier and stem construction, precise alignment of the end toolslide is permanently retained.

One of the outstanding design features of all Acme-Gridley bar machines is the working relationship between the end toolslide and the spindle carrier. This forged steel toolslide is supported on sleeve bearings; it does not revolve or index with the carrier but slides forward and backward on the stem to carry the end-working tools to and from contact with the bars of stock. In addition to being supported by the carrier stem, the end toolslide is guided by a massive bracket that moves along a guide, below and parallel to the slide. A positive stop arrests the slide travel for accurate depth control of drills, reamers and end-turning tools. The toolslide surfaces for mounting toolholders are precision ground to provide perfect alignment with the work spindles.

In operation, the spindle carrier is indexed to bring the work spindles successively into line with the various tools mounted on the end toolslide and the lower, intermediate and upper cross slides. This is accomplished by a mechanism which indexes the carrier during the idle time portion of the machine cycle after tools are withdrawn from the work. Thru the action of this mechanism, a uniformly accelerated and retarded motion is imparted to the spindle carrier which permits extremely rapid and positive indexing without shock, either at the starting or stopping of the indexing movement. Thus, the carrier and its operating mechanism are protected against excessive strain, and indexing is carried on at high speed to reduce time between productive movements to a minimum.

There are many more things to see and learn about Acme-Gridley bar machines than space in this introduction permits but which the manual will provide. If this introduction has given you a general idea as to the nature of these unique and challenging machines, it will have served its purpose in introducing you to what follows.

TABLE OF SECTIONS

subject	section
SAFETY	**A**
CONSTRUCTION	**B**
INSTALLATION	**C**
SETUP	**D**
OPERATION	**E**
MAINTENANCE	**F**
TROUBLESHOOTING	**G**
APPENDIX	**H**

A
E
B
F
C
G
D
H

SECTION A: SAFETY
Table of Contents

General Safety Rules 3
Standard Pneumatic Procedures 5
Standard Electrical Procedures 6
General Operating Procedures 7
Tooling Procedures and Adjustments 9
General Maintenance 12

SAFETY

Acme-Gridley Multiple Spindle Bar Machines are designed to be safe to operate, safe to set up, safe on which to install tooling, safe to maintain and safe to repair. Although safe machine operation is the responsibility of the user, this Safety section is offered as an aid in reminding the reader how to prevent accidental injury.

Promote your personal safety and help prevent injury to yourself and your co-workers by following the suggestions offered and by referring to recommended procedures listed in the other sections of this manual. However, no safety text can cover every situation that might occur — such as others modifying the original machine design from what it was at the time of manufacture or the use of tooling and/or attachments not manufactured by National Acme. Because of the versatility of Acme-Gridley bar machines, they are generally retooled many times throughout their useful life. Each time that a machine is retooled, the operator should make a point of determining that it has been carefully checked by a qualified safety engineer or safety manager. By doing this, unsafe tooling practices can be avoided, and personal injury prevented.

National Acme conforms to the scope and provisions set forth by American National Standard ANSI B 11.13 (ANSI approved 8-6-75), which covers the safety requirements for the construction, care and use of multiple spindle bar machines.

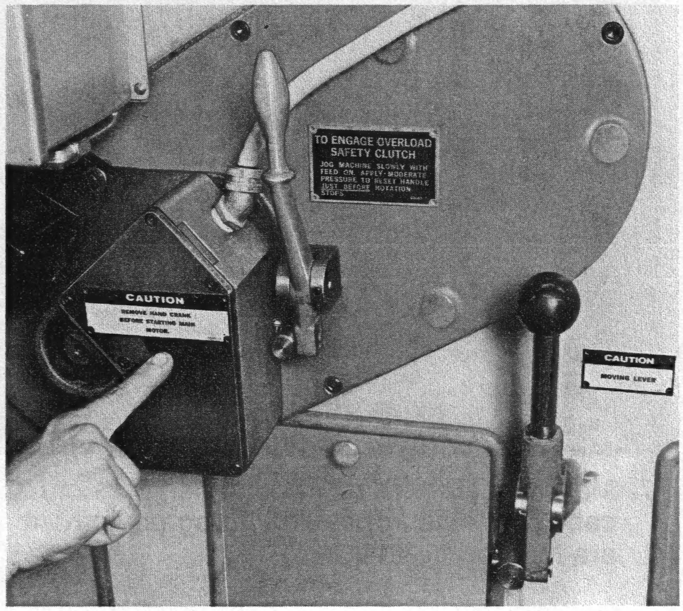
But, no matter how much care is exercised by the manufacturer to insure personal safety, in the final analysis, it is up to the individual to follow those operating procedures that have been found effective in accident prevention.

Refer to this Safety section and the other sections of this manual often — especially when evaluating a new setup or unusual job. And remember that safe machine operation is the user's responsibility.

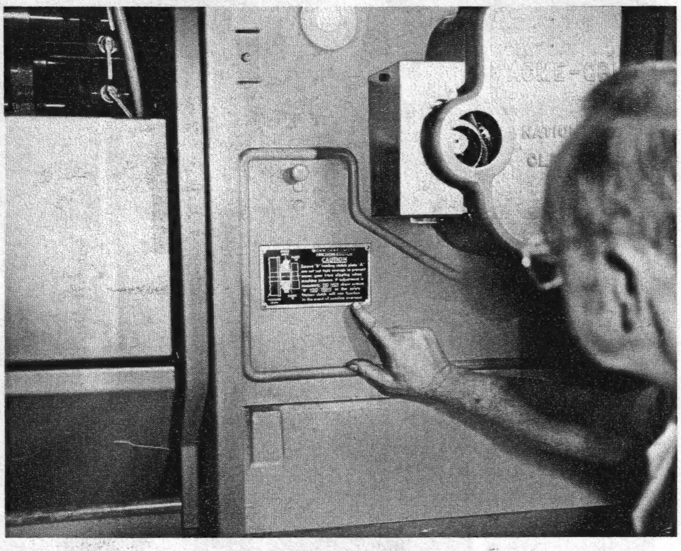
CAUTION: National Acme recommends that machine operators wear safety equipment such as safety glasses, proper fitting clothes, safety shoes, and, where necessary, protective hearing devices and headgear.

ACME-GRIDLEY
CLEVELAND, O. U.S.A.
National Acme Operator's Safety Manual

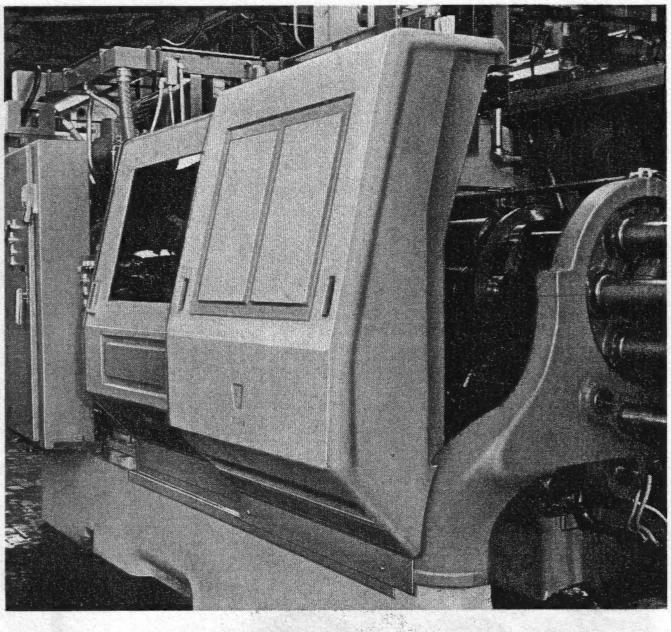
General Safety Rules


TO ENGAGE OVERLOAD SAFETY CLUTCH
JOG MACHINE SLOWLY WITH FEED ON. APPLY MODERATE PRESSURE TO RESET HANDLE JUST BEFORE ROTATION STOPS.
CAUTION
REMOVE HAND CRANK BEFORE STARTING MAIN MOTOR.
CAUTION
MOVING LEVER

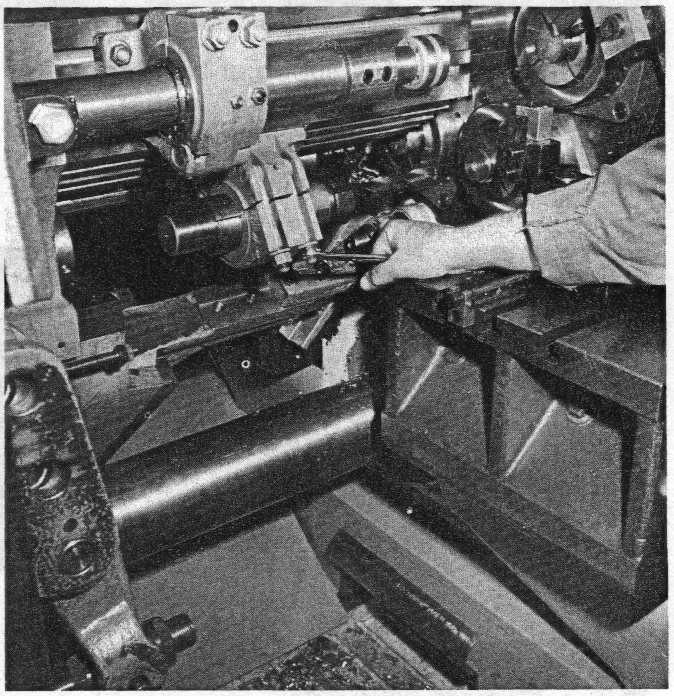
1. Use all safety devices properly and never attempt to remove or bypass them.



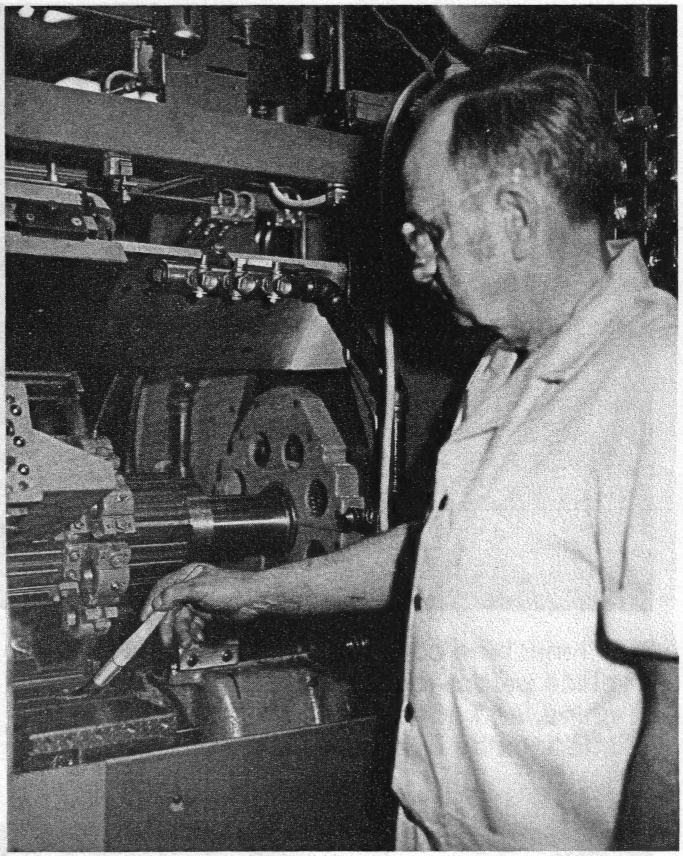
2. Be sure to observe all instruction and warning tags on the machine before starting it.



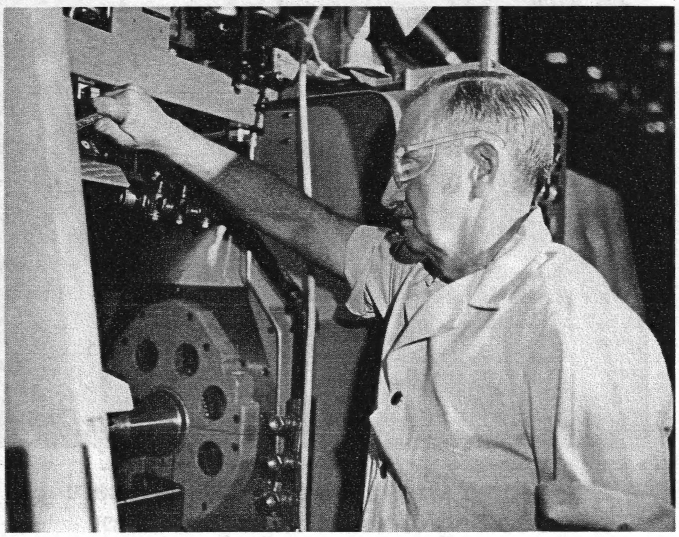
3. All machine covers and guards must be in place before jogging or running the machine, and at no time should a safety interlock be bypassed.



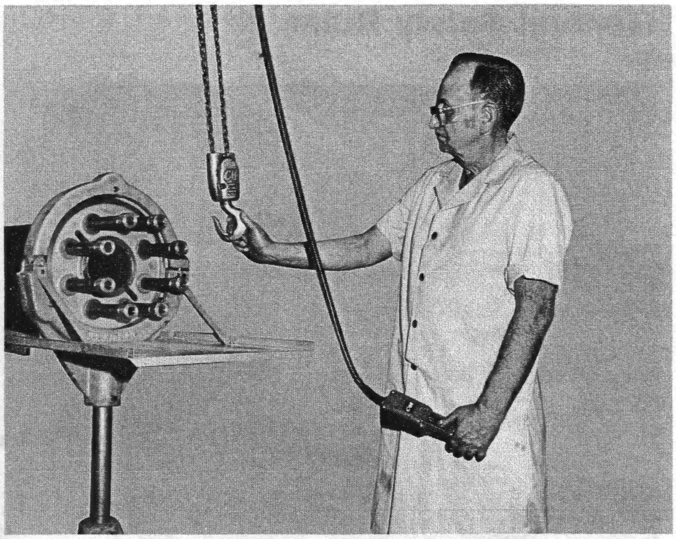
4. Use proper wrenches and exercise care when setting tools, changing tools, or making tool adjustments to prevent injury to hands or arms by tool slippage.



5. Use a brush, small scoop or similar tool to remove chips and/or foreign matter.
   CAUTION: Do not use an air hose to clean away chips or dirt.



6. Wear safety glasses at all times when working around a machine.



7. Make certain that all hand tools, jacks, cables, chains, ropes and lifting equipment are in good condition.

NATIONAL ACME
ACME-GR

8. Always use a fixed ladder if it is ever necessary to climb up on the machine and, then, only if all electrical, pneumatic and/or hydraulic power is OFF — never use chairs, stools, barrels or boxes.

9. Be sure you understand all machining functions and tooling applications. If you have any questions, ask the supervisor or tooling setup man to check you out before starting the machine.

10. Keep all articles off the machine, including loose gages, tools and machined parts.

11. Be cautious of all moving machine levers, hot chips, coolant, lubricants, hydraulic fluid, tooling and work pieces.

12. Make sure that you thoroughly understand the machine you are assigned to operate.

13. Keep all hand tools in a toolbox — not in your pockets or stuck in your belt.

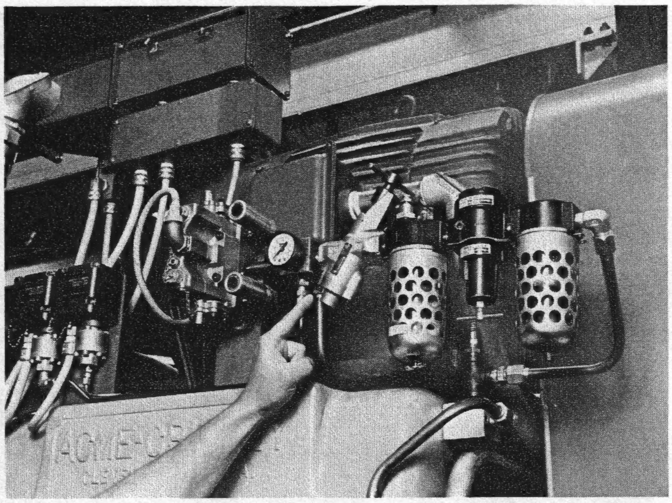
14. Wear proper fitting clothing and, where necessary, headgear to protect long hair or beards at all times.

15. Conduct yourself as an intelligent adult around the machine — never engage in or encourage any horse-play.

16. Wear protective hearing devices in excessively noisy areas.

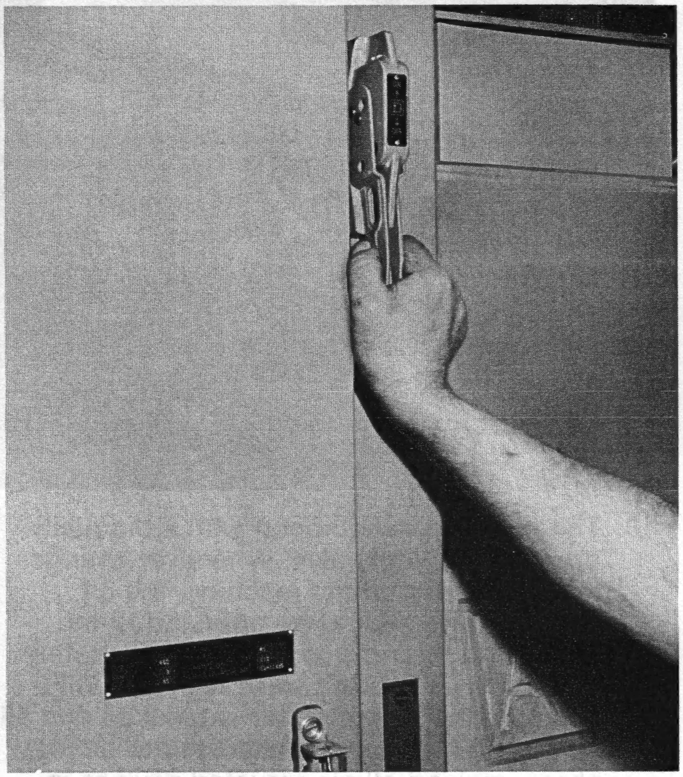
17. Turn the machine OFF before working on or crawling under the stock reel. The machine must also be OFF when loading the stock reel.

Standard Pneumatic Procedures

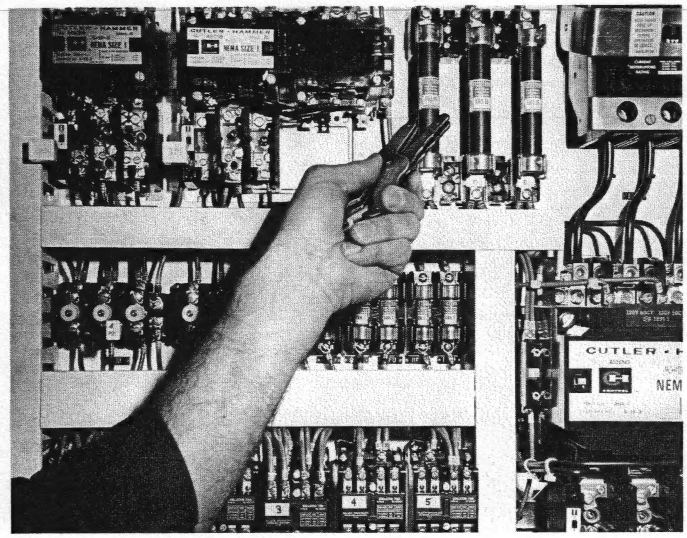


18. The machine is equipped with a manually operated lockout valve. Whenever changes must be made on the machine, the air lockout valve should be operated to the OFF position and a lock applied for safety. When the air lockout valve is in the OFF position, the incoming air is blocked and all air on the machine is exhausted to atmosphere, making all air-actuated devices inoperative.

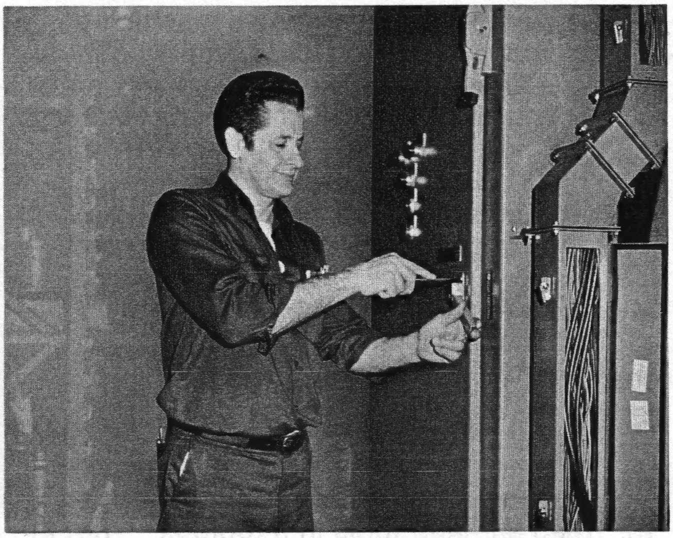
Standard Electrical Procedures



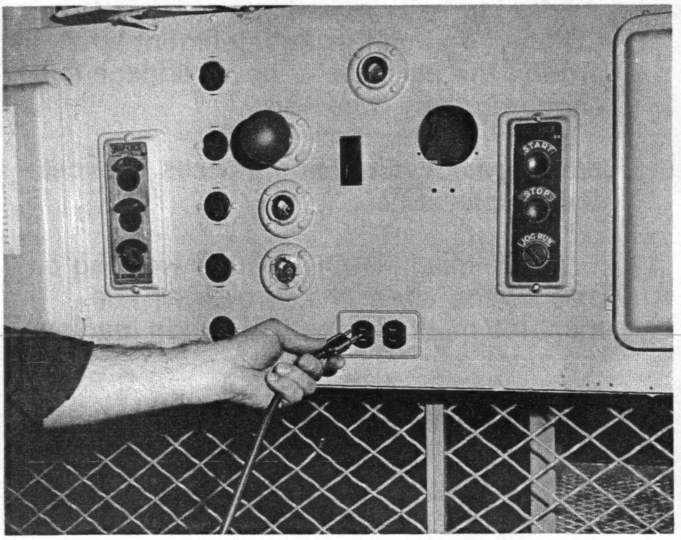
19. Perform all tool changing, maintenance, lubrication and cleaning only when the main disconnect is in the OFF position.



20. Replace fuses, heaters and circuit breakers only with devices of the same electrical rating as those originally furnished by National Acme.



21. Only authorized electrical technicians should have access to electrical control cabinets, junction boxes or control stations.

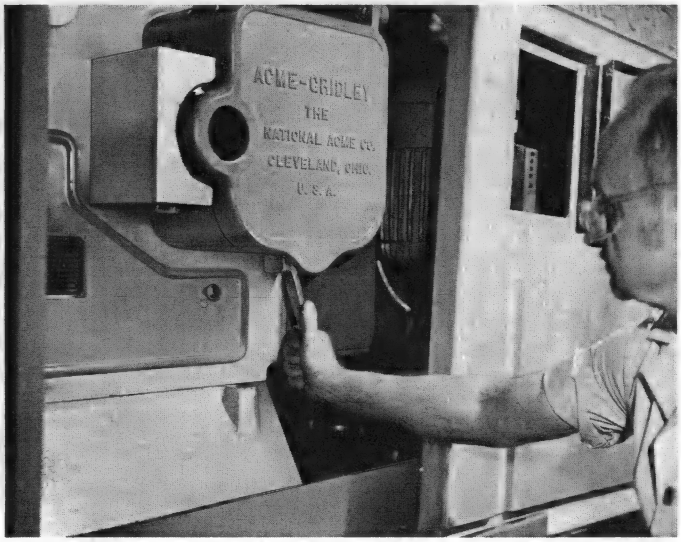


22. Be sure that all portable electric power tools are properly grounded before using them.

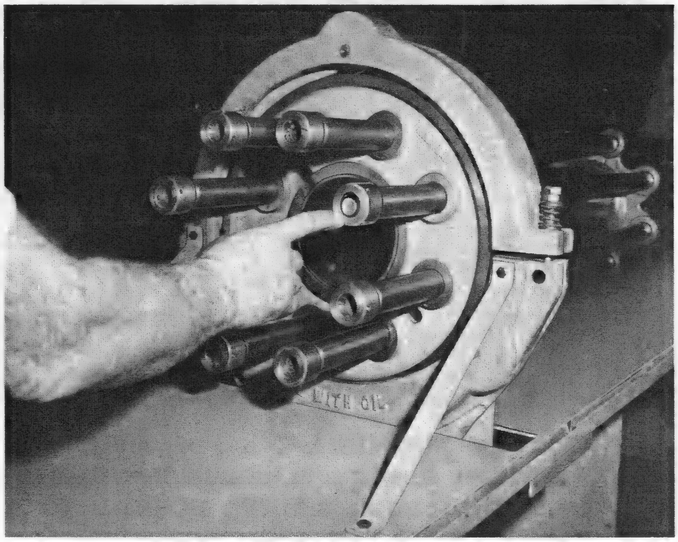
23. Only qualified electrical, pneumatic or hydraulic technicians should work on respective circuitry.

24. Be sure your hands are dry and you are standing on a dry surface any time you touch electrical equipment. Make sure that the floor area is clear of all fluids.

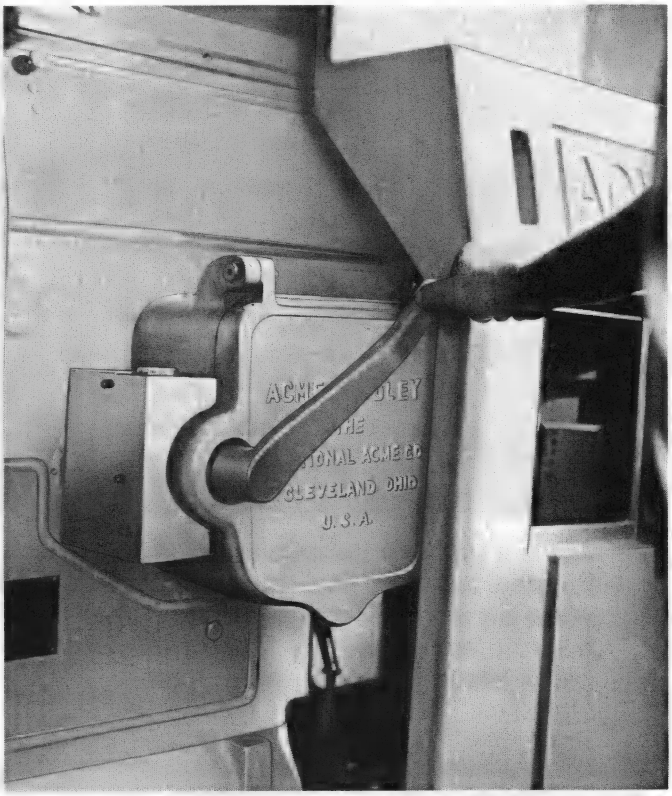
General Operating Procedures



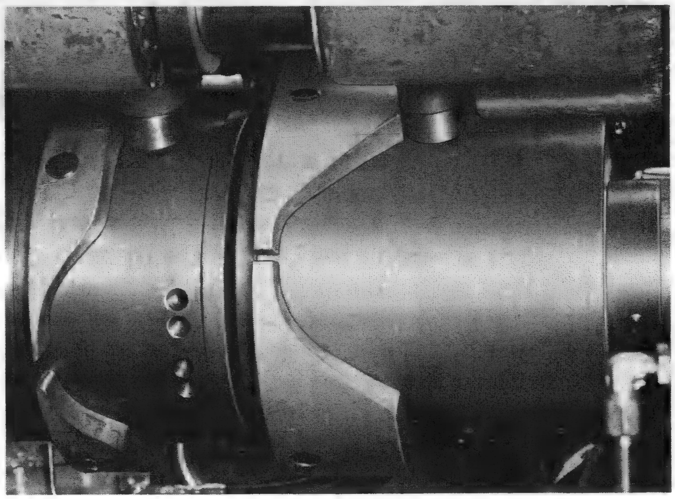
25. Disengage the high speed clutch whenever the machine is stopped on "half index." Put the machine's controls in JOG mode and index-jog the machine slowly. Be sure chucking shoe and spool are in alignment before completing the index.



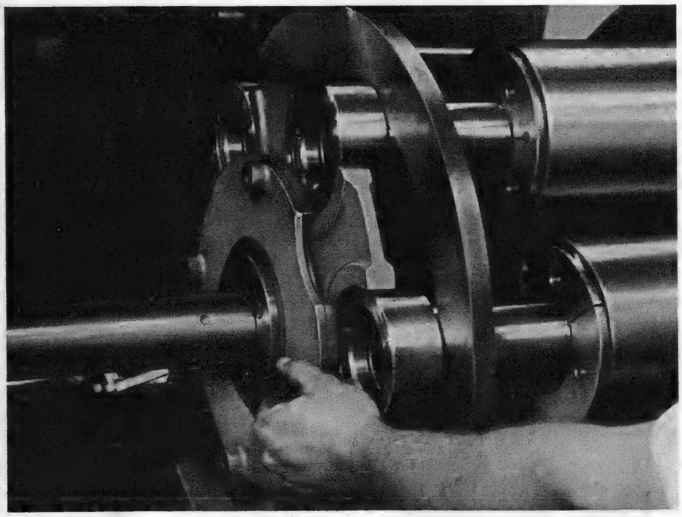
26. Keep the full length of each bar stock inside its stock reel tube. Be sure to use proper stock tube liners, spool bushings, etc.



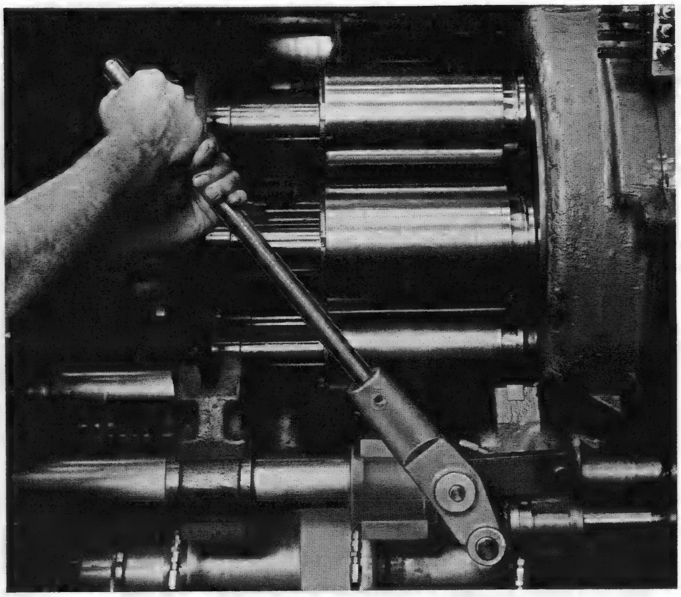
27. Use the proper hand crank on those machines so equipped and only when the feed and/or power reverse is disengaged and the main disconnect is in the OFF position. **Remember, do not operate hand crank until power is OFF. Hand crank must always be removed from the worm shaft when not cranking the machine and before starting the main drive motor.**



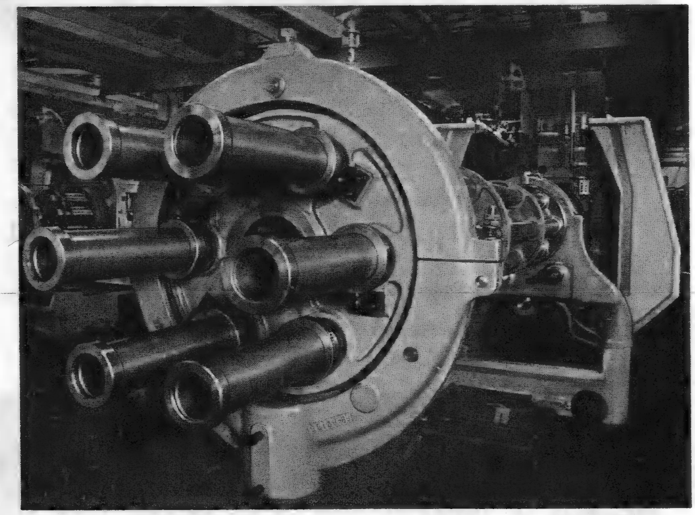
28. Always use proper stock feed cams to prevent unnecessary wear on the pushers (feed fingers).



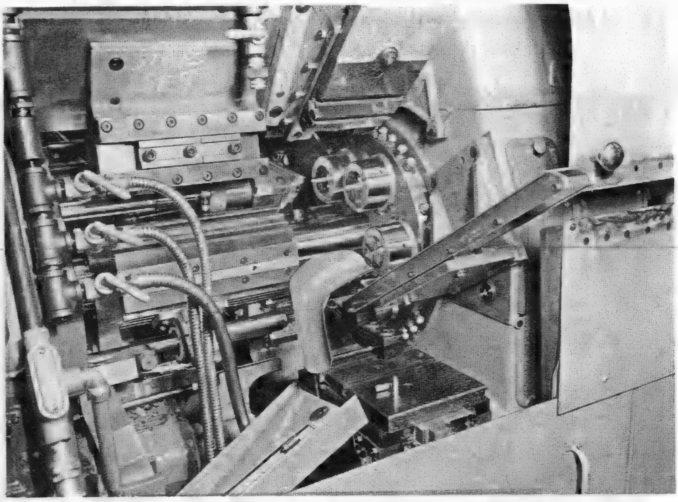
29. Always be sure the pusher tube spool is located between the stock feed ring and the wear plate in the guard disc and that the guard disc is securely locked after loading stock before running the machine.



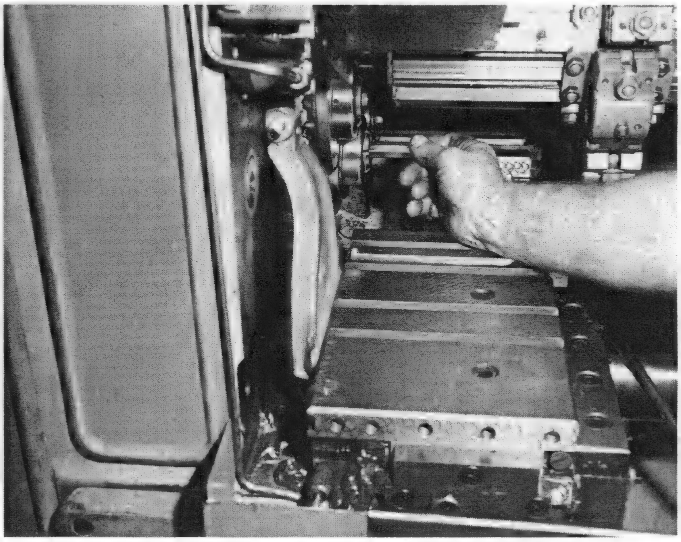
31. Use the hand chucking lever as originally provided when adjusting collets — never add a pipe or other extension for additional leverage.



30. Before running the machine, stock reel tubes must be locked in their seated position. On machines with a clamping belt, be sure all stock reel tubes are in seated position with adequate tension on belt to hold them in place.



32. When the machine is being used for secondary operations (chucking type work), be sure it is equipped with a mechanical loading device that is electrically interlocked. Never hand load a revolving spindle, collet or chuck. Keep all parts of the body out of the tooling area when the machine is operating.



33. Spindles must be stationary when hand loading or unloading bar stock, butt ends, castings, forgings, etc., into or out of the spindles.

34. Be cautious at all times of any external or internal moving machine parts.

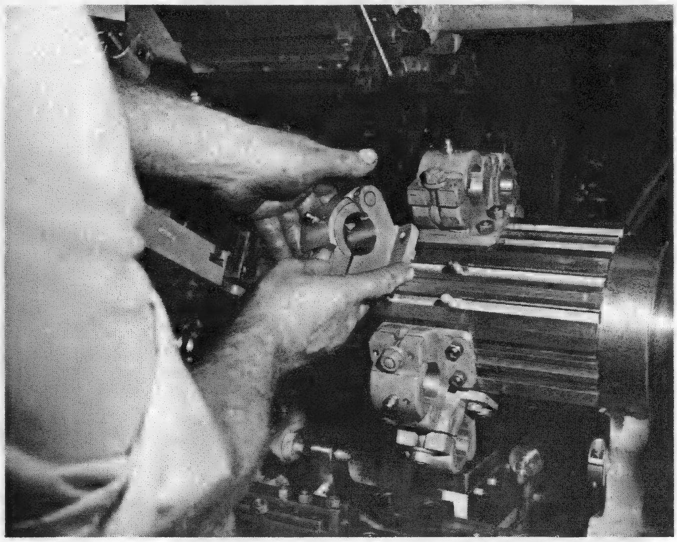
35. Be sure that the correct National Acme collets and pushers (feed fingers) are used and properly adjusted.

36. Keep hands out of the tooling area at all times when the machine is in operation.

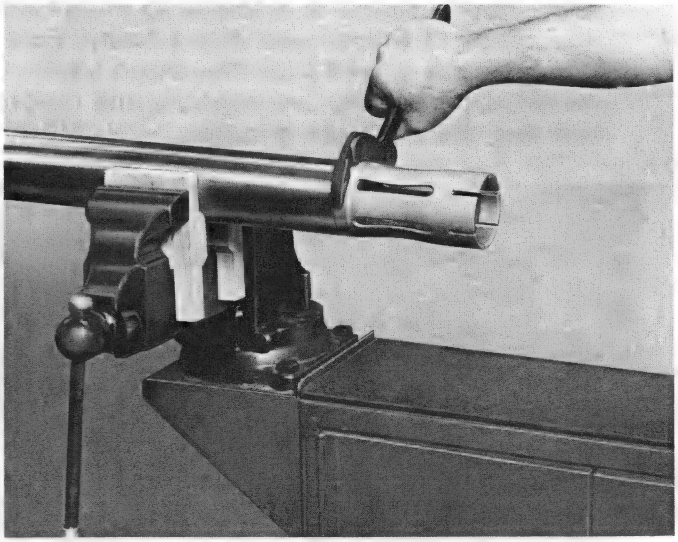
37. Bar stock, tubing, etc., should be straight and end-chamfered to enable them to pass easily thru pushers and collets.

38. Use only genuine National Acme made "Acme-Gridley" replacement parts, tooling and/or attachments when making repairs or replacing machine parts or tooling.

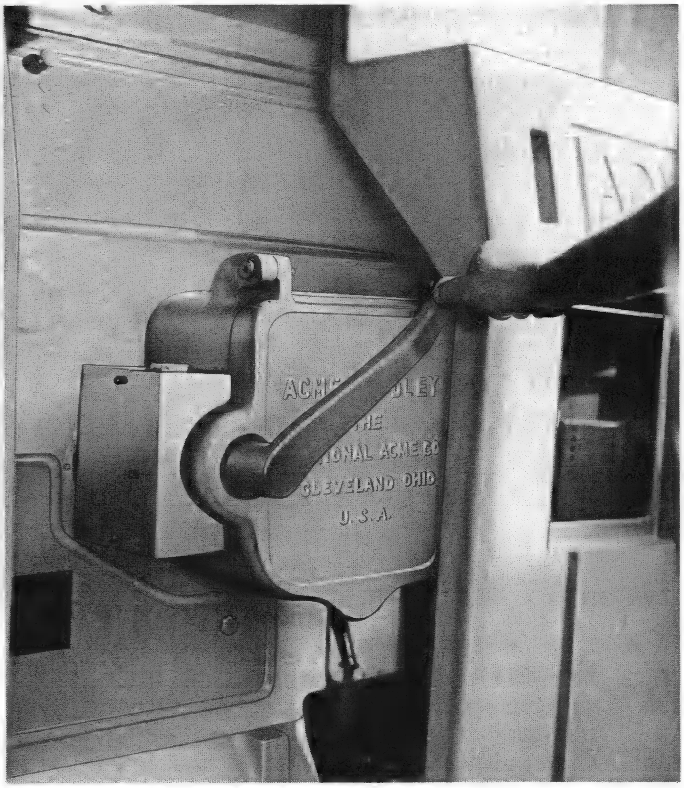
Tooling Procedures and Adjustments



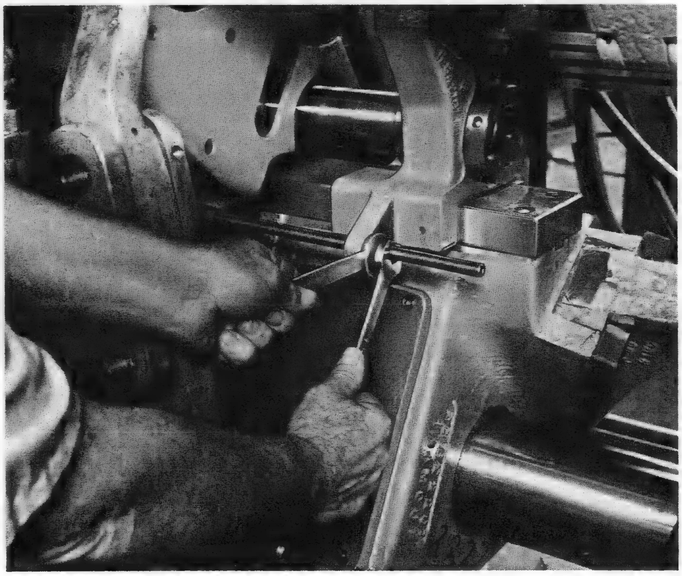
39. Use proper National Acme end toolslide toolholders. Each toolholder is stamped with the serial number of the machine and its correct position on the toolslide. These numbers should face the gearbox when toolholders are properly mounted.



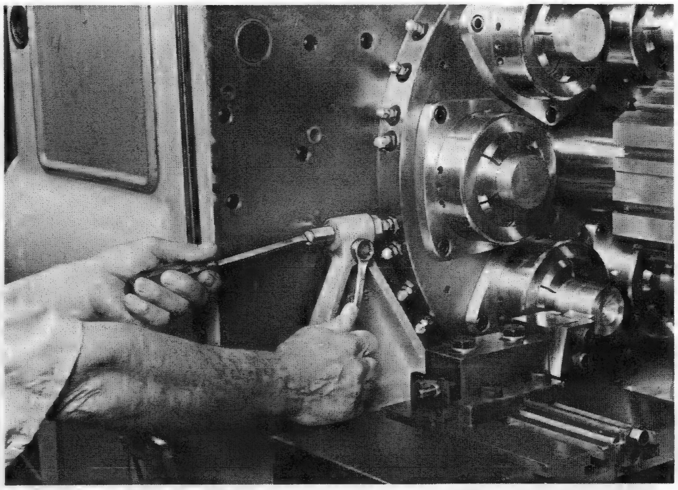
40. Use only proper tools to remove tooling, toolholders or machine parts — never use hard hammers or blocks of steel.



41. Stop the machine should it become "jammed-up." With the main drive motor OFF, hand crank the machine to determine the cause of the jam-up. **Hand crank must always be removed from the worm shaft when not cranking the machine and before starting the main drive motor.**

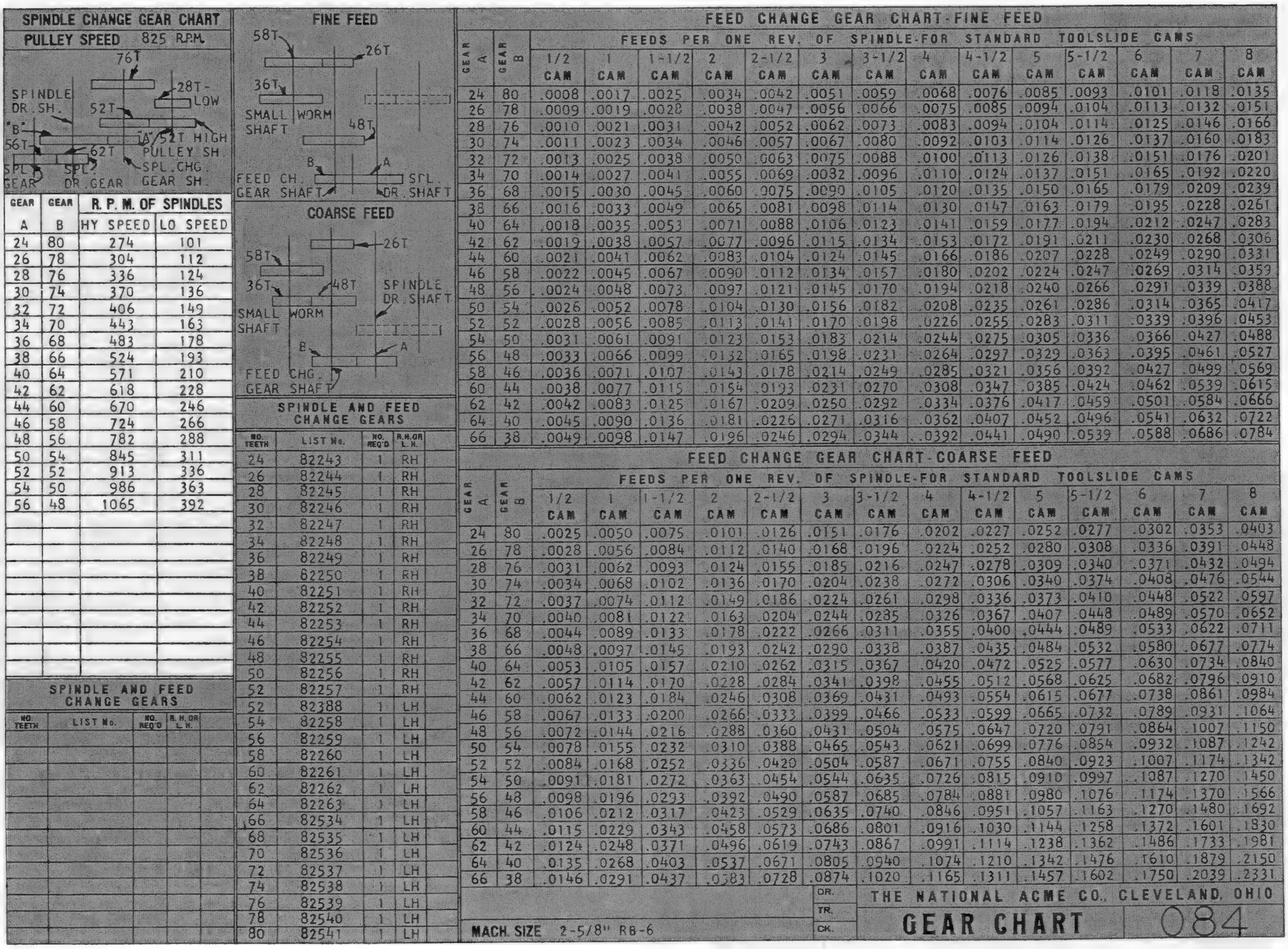


42. Readjust the stop nuts on the end toolslide whenever its cams are changed.



43. Readjust cross slide stops whenever the corresponding cams are changed — never use excessive pressure. Be sure to release these stops when adjusting the cross slides. See the Setup section of this manual for specific instructions.

44. Check roll clearance along the cam path every time a cam is changed and be sure that all cam mounting screws are tightened securely.


76T
28T-LOW
SPINDLE DR. SH.
52T
"B"
56T
"A" 52T HIGH
62T
PULLEY SH.
SPL. CHG. GEAR SH.
SPL. GEAR
SPL. DR. GEAR
FINE FEED
58T
26T
36T
SMALL WORM SHAFT
48T
B
A
FEED CH. GEAR SHAFT
SPL. DR. SHAFT
COARSE FEED
58T
26T
36T
48T
SPINDLE DR. SHAFT
SMALL WORM SHAFT
B
A
FEED CHG. GEAR SHAFT

SPINDLE CHANGE GEAR CHART

PULLEY SPEED 825 R.P.M.

GEAR A	GEAR B	R. P. M. OF SPINDLES HY SPEED	R. P. M. OF SPINDLES LO SPEED
24	80	274	101
26	78	304	112
28	76	336	124
30	74	370	136
32	72	406	149
34	70	443	163
36	68	483	178
38	66	524	193
40	64	571	210
42	62	618	228
44	60	670	246
46	58	724	266
48	56	782	288
50	54	845	311
52	52	913	336
54	50	986	363
56	48	1065	392

SPINDLE AND FEED CHANGE GEARS

NO. TEETH	LIST No.	NO. REQ'D	R.H. OR L.H.

SPINDLE AND FEED CHANGE GEARS

NO. TEETH	LIST No.	NO. REQ'D	R.H. OR L.H.
24	82243	1	RH
26	82244	1	RH
28	82245	1	RH
30	82246	1	RH
32	82247	1	RH
34	82248	1	RH
36	82249	1	RH
38	82250	1	RH
40	82251	1	RH
42	82252	1	RH
44	82253	1	RH
46	82254	1	RH
48	82255	1	RH
50	82256	1	RH
52	82257	1	RH
52	82388	1	LH
54	82258	1	LH
56	82259	1	LH
58	82260	1	LH
60	82261	1	LH
62	82262	1	LH
64	82263	1	LH
66	82534	1	LH
68	82535	1	LH
70	82536	1	LH
72	82537	1	LH
74	82538	1	LH
76	82539	1	LH
78	82540	1	LH
80	82541	1	LH

FEED CHANGE GEAR CHART-FINE FEED

FEEDS PER ONE REV. OF SPINDLE-FOR STANDARD TOOLSLIDE CAMS

GEAR A	GEAR B	1/2 CAM	1 CAM	1-1/2 CAM	2 CAM	2-1/2 CAM	3 CAM	3-1/2 CAM	4 CAM	4-1/2 CAM	5 CAM	5-1/2 CAM	6 CAM	7 CAM	8 CAM
24	80	.0008	.0017	.0025	.0034	.0042	.0051	.0059	.0068	.0076	.0085	.0093	.0101	.0118	.0135
26	78	.0009	.0019	.0028	.0038	.0047	.0056	.0066	.0075	.0085	.0094	.0104	.0113	.0132	.0151
28	76	.0010	.0021	.0031	.0042	.0052	.0062	.0073	.0083	.0094	.0104	.0114	.0125	.0146	.0166
30	74	.0011	.0023	.0034	.0046	.0057	.0067	.0080	.0092	.0103	.0114	.0126	.0137	.0160	.0183
32	72	.0013	.0025	.0038	.0050	.0063	.0075	.0088	.0100	.0113	.0126	.0138	.0151	.0176	.0201
34	70	.0014	.0027	.0041	.0055	.0069	.0082	.0096	.0110	.0124	.0137	.0151	.0165	.0192	.0220
36	68	.0015	.0030	.0045	.0060	.0075	.0090	.0105	.0120	.0135	.0150	.0165	.0179	.0209	.0239
38	66	.0016	.0033	.0049	.0065	.0081	.0098	.0114	.0130	.0147	.0163	.0179	.0195	.0228	.0261
40	64	.0018	.0035	.0053	.0071	.0088	.0106	.0123	.0141	.0159	.0177	.0194	.0212	.0247	.0283
42	62	.0019	.0038	.0057	.0077	.0096	.0115	.0134	.0153	.0172	.0191	.0211	.0230	.0268	.0306
44	60	.0021	.0041	.0062	.0083	.0104	.0124	.0145	.0166	.0186	.0207	.0228	.0249	.0290	.0331
46	58	.0022	.0045	.0067	.0090	.0112	.0134	.0157	.0180	.0202	.0224	.0247	.0269	.0314	.0359
48	56	.0024	.0048	.0073	.0097	.0121	.0145	.0170	.0194	.0218	.0240	.0266	.0291	.0339	.0388
50	54	.0026	.0052	.0078	.0104	.0130	.0156	.0182	.0208	.0235	.0261	.0286	.0314	.0365	.0417
52	52	.0028	.0056	.0085	.0113	.0141	.0170	.0198	.0226	.0255	.0283	.0311	.0339	.0396	.0453
54	50	.0031	.0061	.0091	.0123	.0153	.0183	.0214	.0244	.0275	.0305	.0336	.0366	.0427	.0488
56	48	.0033	.0066	.0099	.0132	.0165	.0198	.0231	.0264	.0297	.0329	.0363	.0395	.0461	.0527
58	46	.0036	.0071	.0107	.0143	.0178	.0214	.0249	.0285	.0321	.0356	.0392	.0427	.0499	.0569
60	44	.0038	.0077	.0115	.0154	.0193	.0231	.0270	.0308	.0347	.0385	.0424	.0462	.0539	.0615
62	42	.0042	.0083	.0125	.0167	.0209	.0250	.0292	.0334	.0376	.0417	.0459	.0501	.0584	.0666
64	40	.0045	.0090	.0136	.0181	.0226	.0271	.0316	.0362	.0407	.0452	.0496	.0541	.0632	.0722
66	38	.0049	.0098	.0147	.0196	.0246	.0294	.0344	.0392	.0441	.0490	.0539	.0588	.0686	.0784

FEED CHANGE GEAR CHART-COARSE FEED

FEEDS PER ONE REV. OF SPINDLE-FOR STANDARD TOOLSLIDE CAMS

GEAR A	GEAR B	1/2 CAM	1 CAM	1-1/2 CAM	2 CAM	2-1/2 CAM	3 CAM	3-1/2 CAM	4 CAM	4-1/2 CAM	5 CAM	5-1/2 CAM	6 CAM	7 CAM	8 CAM
24	80	.0025	.0050	.0075	.0101	.0126	.0151	.0176	.0202	.0227	.0252	.0277	.0302	.0353	.0403
26	78	.0028	.0056	.0084	.0112	.0140	.0168	.0196	.0224	.0252	.0280	.0308	.0336	.0391	.0448
28	76	.0031	.0062	.0093	.0124	.0155	.0185	.0216	.0247	.0278	.0309	.0340	.0371	.0432	.0494
30	74	.0034	.0068	.0102	.0136	.0170	.0204	.0238	.0272	.0306	.0340	.0374	.0408	.0476	.0544
32	72	.0037	.0074	.0112	.0149	.0186	.0224	.0261	.0298	.0336	.0373	.0410	.0448	.0522	.0597
34	70	.0040	.0081	.0122	.0163	.0204	.0244	.0285	.0326	.0367	.0407	.0448	.0489	.0570	.0652
36	68	.0044	.0089	.0133	.0178	.0222	.0266	.0311	.0355	.0400	.0444	.0489	.0533	.0622	.0711
38	66	.0048	.0097	.0145	.0193	.0242	.0290	.0338	.0387	.0435	.0484	.0532	.0580	.0677	.0774
40	64	.0053	.0105	.0157	.0210	.0262	.0315	.0367	.0420	.0472	.0525	.0577	.0630	.0734	.0840
42	62	.0057	.0114	.0170	.0228	.0284	.0341	.0398	.0455	.0512	.0568	.0625	.0682	.0796	.0910
44	60	.0062	.0123	.0184	.0246	.0308	.0369	.0431	.0493	.0554	.0615	.0677	.0738	.0861	.0984
46	58	.0067	.0133	.0200	.0266	.0333	.0399	.0466	.0533	.0599	.0665	.0732	.0789	.0931	.1064
48	56	.0072	.0144	.0216	.0288	.0360	.0431	.0504	.0575	.0647	.0720	.0791	.0864	.1007	.1150
50	54	.0078	.0155	.0232	.0310	.0388	.0465	.0543	.0621	.0699	.0776	.0854	.0932	.1087	.1242
52	52	.0084	.0168	.0252	.0336	.0420	.0504	.0587	.0671	.0755	.0840	.0923	.1007	.1174	.1342
54	50	.0091	.0181	.0272	.0363	.0454	.0544	.0635	.0726	.0815	.0910	.0997	.1087	.1270	.1450
56	48	.0098	.0196	.0293	.0392	.0490	.0587	.0685	.0784	.0881	.0980	.1076	.1174	.1370	.1566
58	46	.0106	.0212	.0317	.0423	.0529	.0635	.0740	.0846	.0951	.1057	.1163	.1270	.1480	.1692
60	44	.0115	.0229	.0343	.0458	.0573	.0686	.0801	.0916	.1030	.1144	.1258	.1372	.1601	.1830
62	42	.0124	.0248	.0371	.0496	.0619	.0743	.0867	.0991	.1114	.1238	.1362	.1486	.1733	.1981
64	40	.0135	.0268	.0403	.0537	.0671	.0805	.0940	.1074	.1210	.1342	.1476	.1610	.1879	.2150
66	38	.0146	.0291	.0437	.0583	.0728	.0874	.1020	.1165	.1311	.1457	.1602	.1750	.2039	.2331

MACH. SIZE 2-5/8" RB-6

DR.
TR.
CK.

THE NATIONAL ACME CO., CLEVELAND, OHIO

GEAR CHART 084

45. Be sure spindle speed never exceeds that specified on the machine's gear chart.

46. Provide all tools with adequate support and keep tool overhang to a minimum.

47. Set tool shanks into the toolholders as far as the nature of the job will allow. Also, consider chip clearance between tools.

48. Adjust all mechanical clutches and brakes properly. See the Maintenance section of this manual for specific instructions.

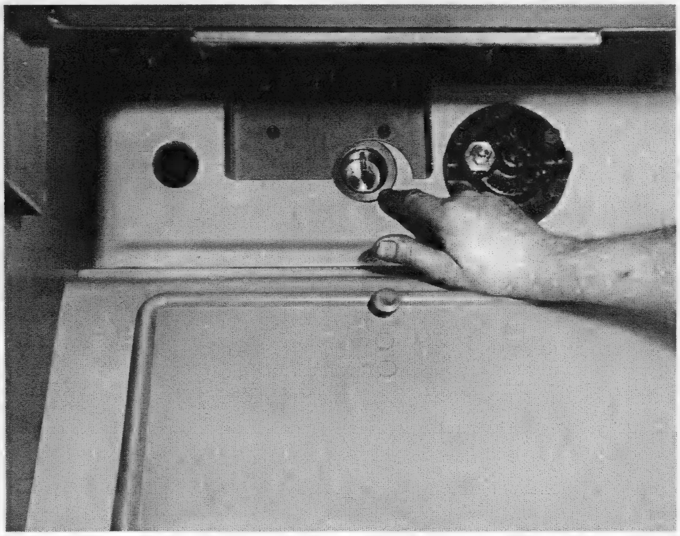
49. All work performed on the machine must be within the capacity limits specified by National Acme.

50. When setting up machine tooling, be sure an adequate supply of cutting coolant is properly directed toward the cutting edge of the cutting tools.

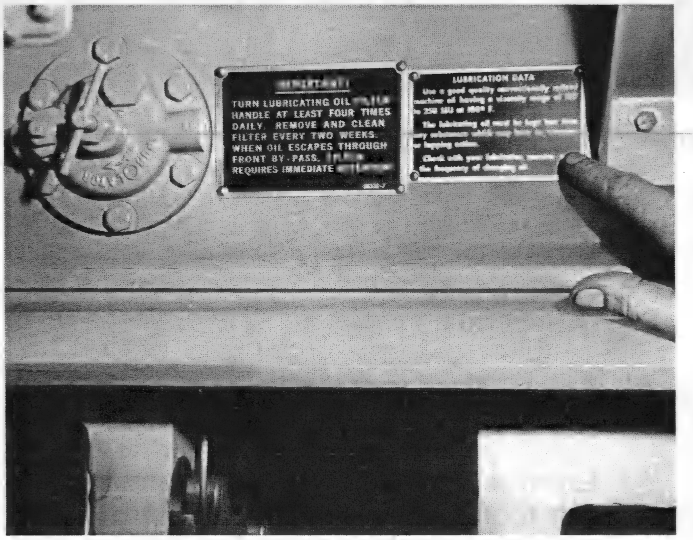
51. Always disengage the feed clutch before stopping the main drive motor.

52. Exercise caution in setting tools to be sure that tools will not interfere with other tooling or machine parts. Usually it is best to jog the machine thru initial settings. After this, allow sufficient time for the lubrication system to function properly before engaging the feed clutch.

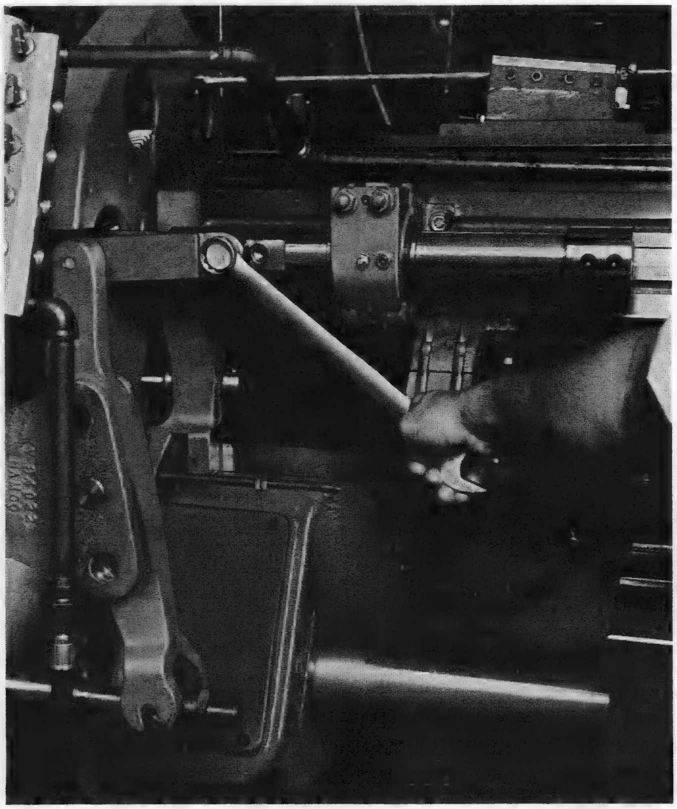
General Maintenance



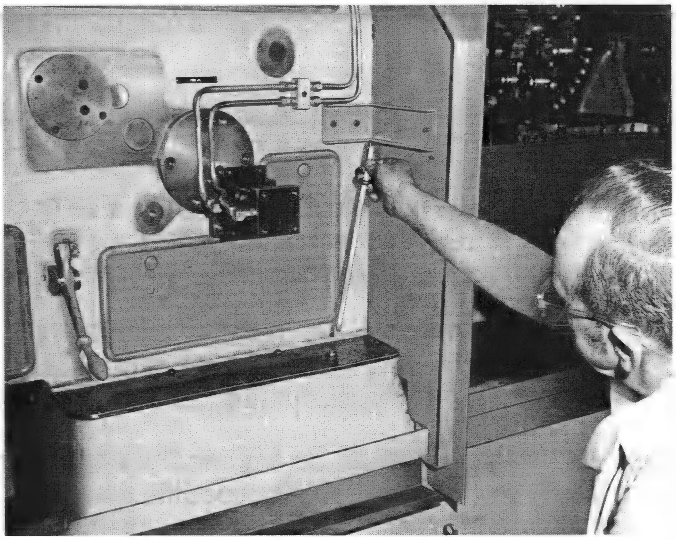
53. Check the sight flow gage frequently while running the machine to assure a steady flow of lubricating oil. Remove coolant from the pan (only when the main disconnect is in the OFF position) and thoroughly clean the coolant reservoir to remove all sediment and fine chips.


TURN LUBRICATING OIL
HANDLE AT LEAST FOUR TIMES
DAILY. REMOVE AND CLEAN
FILTER EVERY TWO WEEKS.
WHEN OIL ESCAPES THROUGH
FRONT BY-PASS,
REQUIRES IMMEDIATE
LUBRICATION DATA

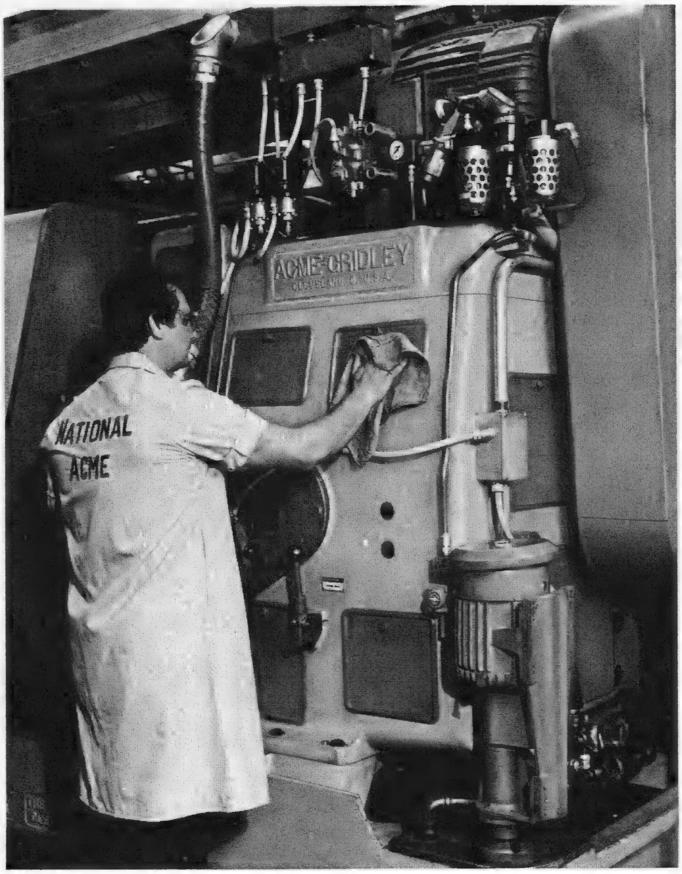
54. Follow the instructions on the main oil filter tags and clean the screens over the lubrication and coolant intake pipes at regular intervals. Screens should be kept in place at all times.



55. Check the machine at regular intervals to assure that all bolts, screws and fasteners are in place and tightened securely — a properly maintained machine is a safe machine.



56. Always be sure there is a sufficient quantity of lubricating oil in the reservoir. Check that it is of the proper type, viscosity and flash point (high enough to prevent oil vapor ignition).



57. Take pride in the machines you operate. Clean the machine daily, especially removing chips and dirt from all vital areas. This prolongs the life of the machine and results in better products.
    CAUTION: Do not use an air hose to clean away chips or dirt.

58. Proper lubrication is essential for safe machine operation. Check the Installation and Maintenance sections of this handbook for the complete lubrication schedule.

59. Check the machine regularly and let a supervisor know if adjustments or maintenance are required.

SECTION B: CONSTRUCTION
Table of Contents

Principle of Operation 2
Overall Construction 8
  Frame 8
  Power Transmission System 9
    Spindle Speed Drive 10
    Feed Drive 12
    High Speed Drive (Idle Time) 13
  Spindle Carrier System 14
  Stock Feeding System 16
  Cross Slide System 18
  End Toolslide System 20
  Cam Identification 20
  Component Identification 22
    2⅝″ RB-6 23
    7/16″ RA-6 24
    9/16″ and 1″ RA-6, 9/16″ and 1″ RAN-6 24
    ⅝″ RN-6 25
    1¼″ RA-6 25
    1⅝″ and 2″ RB-6 26
    6″ RB-6 27
  Control System 28
    Pushbutton Stations 28
    Pneumatic Controls 30

Principle of Operation

Basically, an Acme-Gridley Multiple Spindle Bar Machine is a lathe-type machine that has four, six or eight work holding spindles. The main operating parts (Fig. B-1) are a main drive motor, power transmission, spindle carrier assembly, end toolslide, cross slides and stock feeding mechanism.

The main drive motor provides the power to operate the entire machine. The power transmission transmits this power to the various sections of the machine. The spindle carrier assembly supports and indexes the four, six or eight bars of stock from which the parts are made. The end toolslide provides a mounting surface for the tools that machine the bar stock from the end and moves these tools into and back from the bar stock. The cross slides (four or six) provide a mounting surface for the tools that machine the bars from the side and move these tools into and back from the bars. The stock feeding mechanism automatically advances the bar stock into the machining area as required.

NOTE: Most of the illustrations shown in this handbook are of the latest 2⅝" RB-6 model machine. Other models may have slightly different components than those shown.

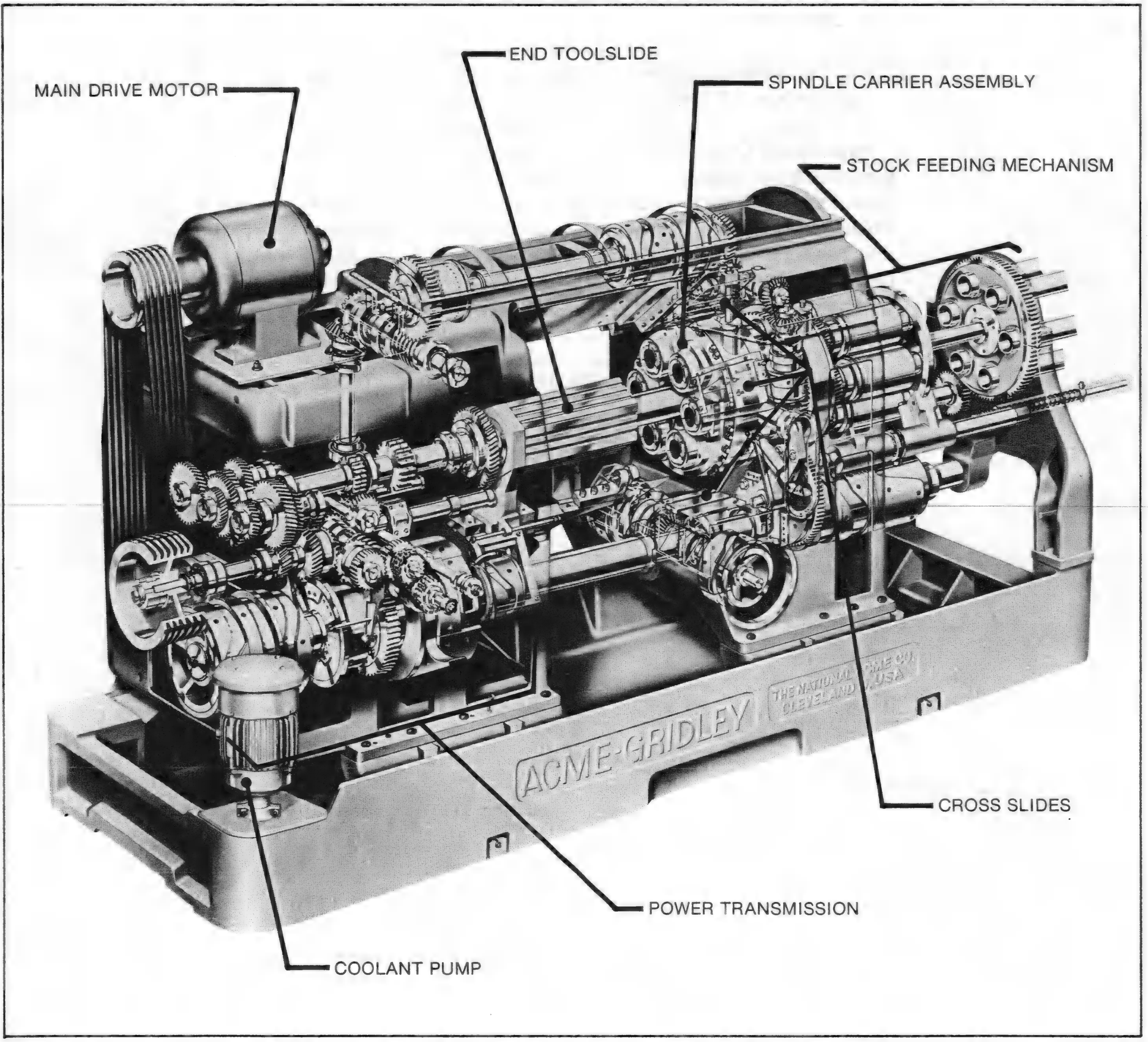

END TOOLSLIDE
MAIN DRIVE MOTOR
SPINDLE CARRIER ASSEMBLY
STOCK FEEDING MECHANISM
CROSS SLIDES
POWER TRANSMISSION
COOLANT PUMP
ACME-GRIDLEY
THE NATIONAL ACME CO. CLEVELAND U.S.A.

Fig. B-1. Main operating parts of an Acme-Gridley Multiple Spindle Bar Machine. (2⅝" RB-6)

Each spindle assembly in the spindle carrier holds one length of bar stock and each spindle rotates independently of the other spindles, thereby rotating its bar. The spindle carrier indexes the spindles around the axis of the spindle carrier. (Fig. B-2) It does this one position at a time, stopping at each position to permit the machining operations to take place. This function is referred to as "indexing" the spindle carrier. A six-spindle machine, for example, will make six indexes to move one spindle around the complete circle.

Once the first spindle has been indexed thru the four, six or eight positions of the machine, each index of the spindle carrier thereafter brings one spindle into the final position where a finished part is delivered from the machine. As an option, any machine can be built to provide for double indexing with the spindle carrier indexing two positions between each machining operation.

All spindles are geared to rotate at the same speed and in the same direction. As an option, any machine can be equipped with a spindle stopping mechanism so one or more spindles may be stopped and held stationary at one or more of the spindle positions.

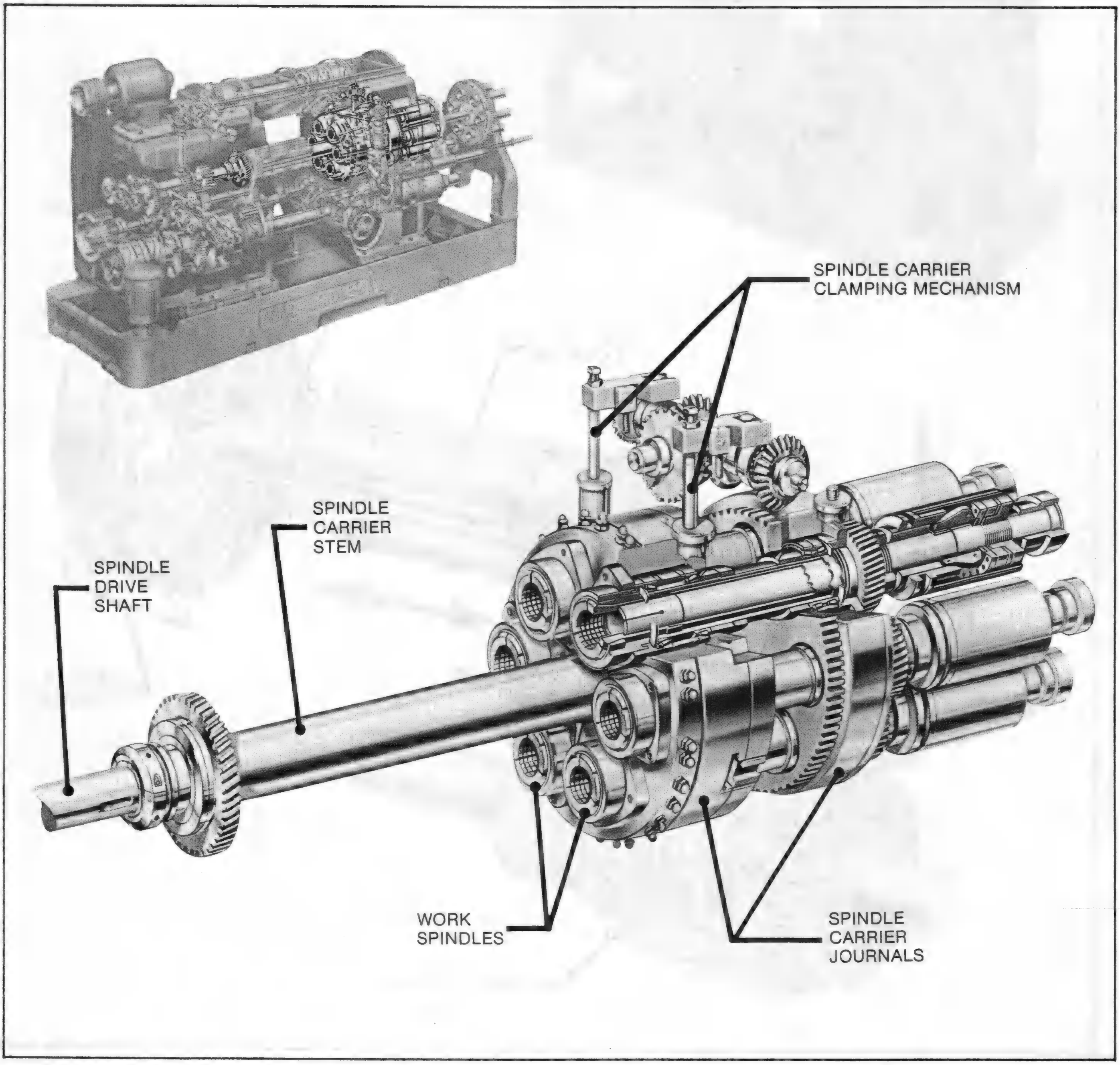


Fig. B-2. The spindles rotate the bar stock and the spindle carrier indexes the spindles. ($2\frac{5}{8}$" RB-6)

The end toolslide is located on the spindle carrier stem in line with the spindle carrier and has a mounting surface for a toolholder for each spindle. (Fig. B-3) There are as many mounting surfaces as there are spindles on the machine. The end toolslide is cammed to feed end-working tools toward and away from the work spindles at two rates of feed, a fixed rapid feed for approach and return and a preselected feed rate for actual machining.

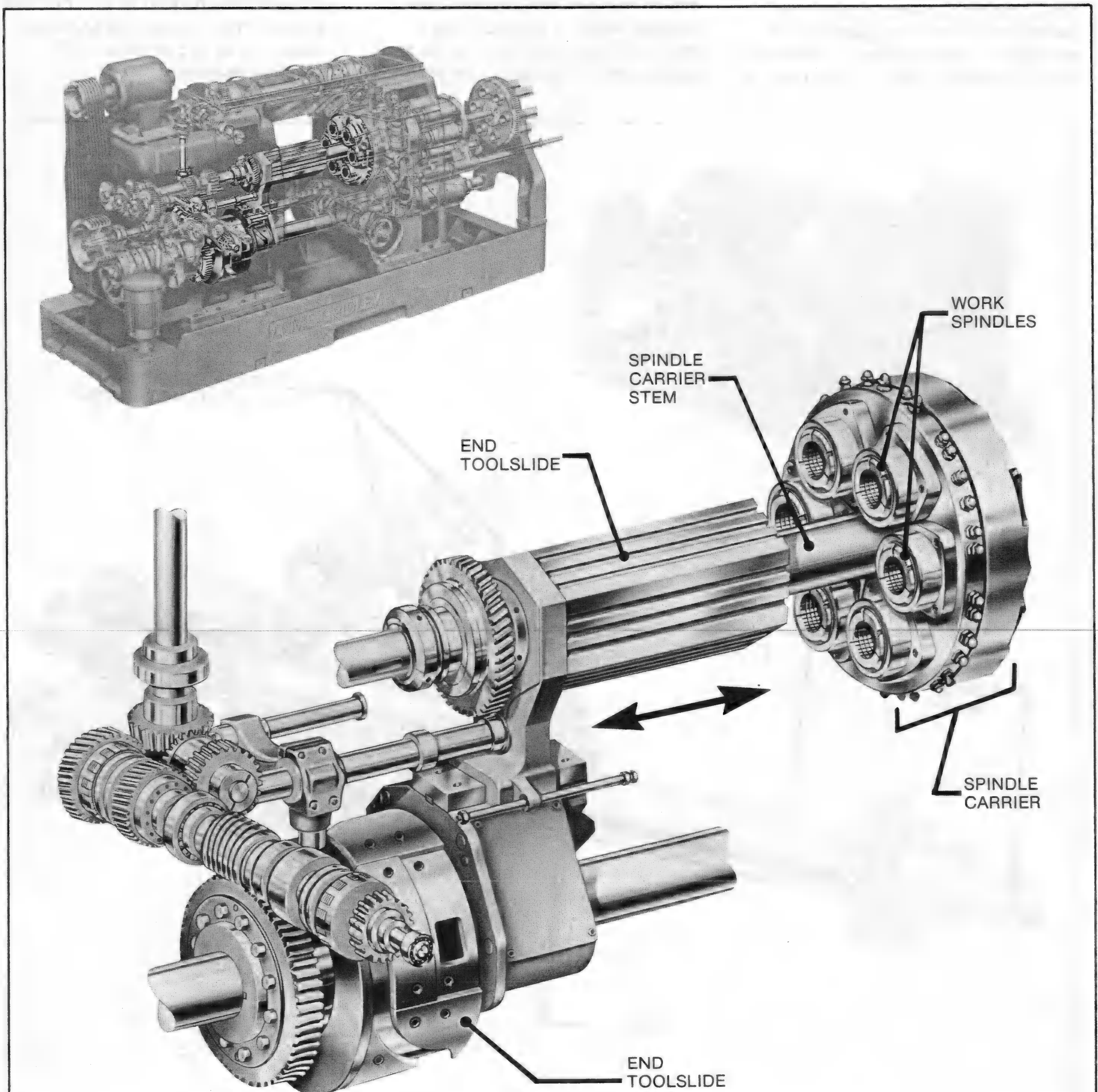

WORK SPINDLES
SPINDLE CARRIER STEM
END TOOLSLIDE
SPINDLE CARRIER
END TOOLSLIDE CAMS

Fig. B-3. The end toolslide holds and moves the end-working tools. (2⅝" RB-6)

The cross slides are mounted in a circle around the spindle carrier. (Fig. B-4) Each slide is moved by its own cam and, therefore, the rate of feed for each cross slide can be different from the other slides if desired. As with the end toolslide, the approach and return movements are accelerated and the machining feed is at a preselected feed rate. In general, the two lower cross slides are used for making heavy rough forming cuts with side-working tools while the other cross slides are used to complete subsequent machining operations. Standard cams for any machine are designed so that all tools start and end their cutting at the same time.

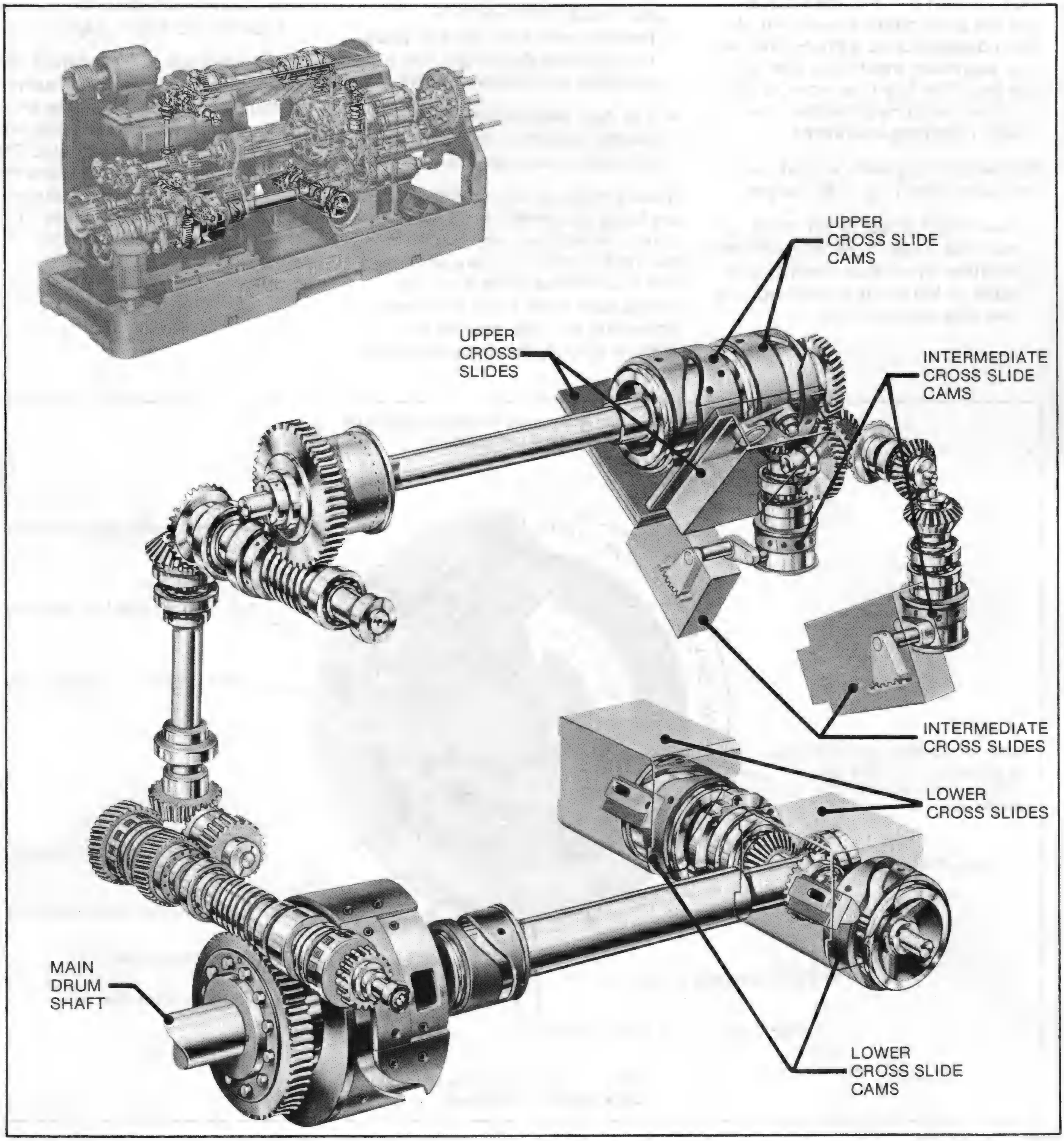

UPPER CROSS SLIDE CAMS
UPPER CROSS SLIDES
INTERMEDIATE CROSS SLIDE CAMS
INTERMEDIATE CROSS SLIDES
LOWER CROSS SLIDES
MAIN DRUM SHAFT
LOWER CROSS SLIDE CAMS

Fig. B-4. The cross slides hold and move the side-working tools. (2⅝″ RB-6)

During one cycle of operation, the end toolslide and all cross slide tools simultaneously advance, perform their cutting operations and retract. The spindle carrier then indexes one position, advancing all spindles one work station. The bar stock in the stock feed position is fed to the stock stop and the cycle repeats itself. (Fig. B-5) One complete cycle is divided into two time segments: machining time and idle time. The idle time includes all machine functions other than the actual machining operations.

Following one spindle around the complete circle (Fig. B-6), we get:

1. One length of bar is fed to the required length in the last numbered position after which machining is done on the bar by the end-working and side-working tools.
2. The spindle carrier indexes the bar to the first position where further machining operations are made by the next set of tools.
3. The indexing and machining operations are repeated at each successive spindle position until the next to last position is reached, where the finished piece is cut off and discharged into a container or conveyor system.
4. The next index repeats the bar feeding operation and the complete sequence is repeated.

Since a repeated series of operations are being performed on all spindles concurrently, one piece is started, the intermediate steps are performed and one finished piece is cut off during each cycle of the machine. Therefore, the time required to perform the longest single operation is the total "machining time." Consequently, cycle time, or time per piece, equals "machining time" plus "idle time."

> NOTE: "Machining time" must also include an additional 5% of the machining time to allow for "cam dwell." Refer to Appendix, section H, page 11.

During operation of the machine, the feeding of the bar stock, the indexing of the spindles, the feeding of the tools and the cutting off of the finished work piece are all done automatically. Only the loading of new bar stock and the maintenance of the tools are done manually. The removal of chips from the pan of the machine can also be automated by the use of a chip conveyor.

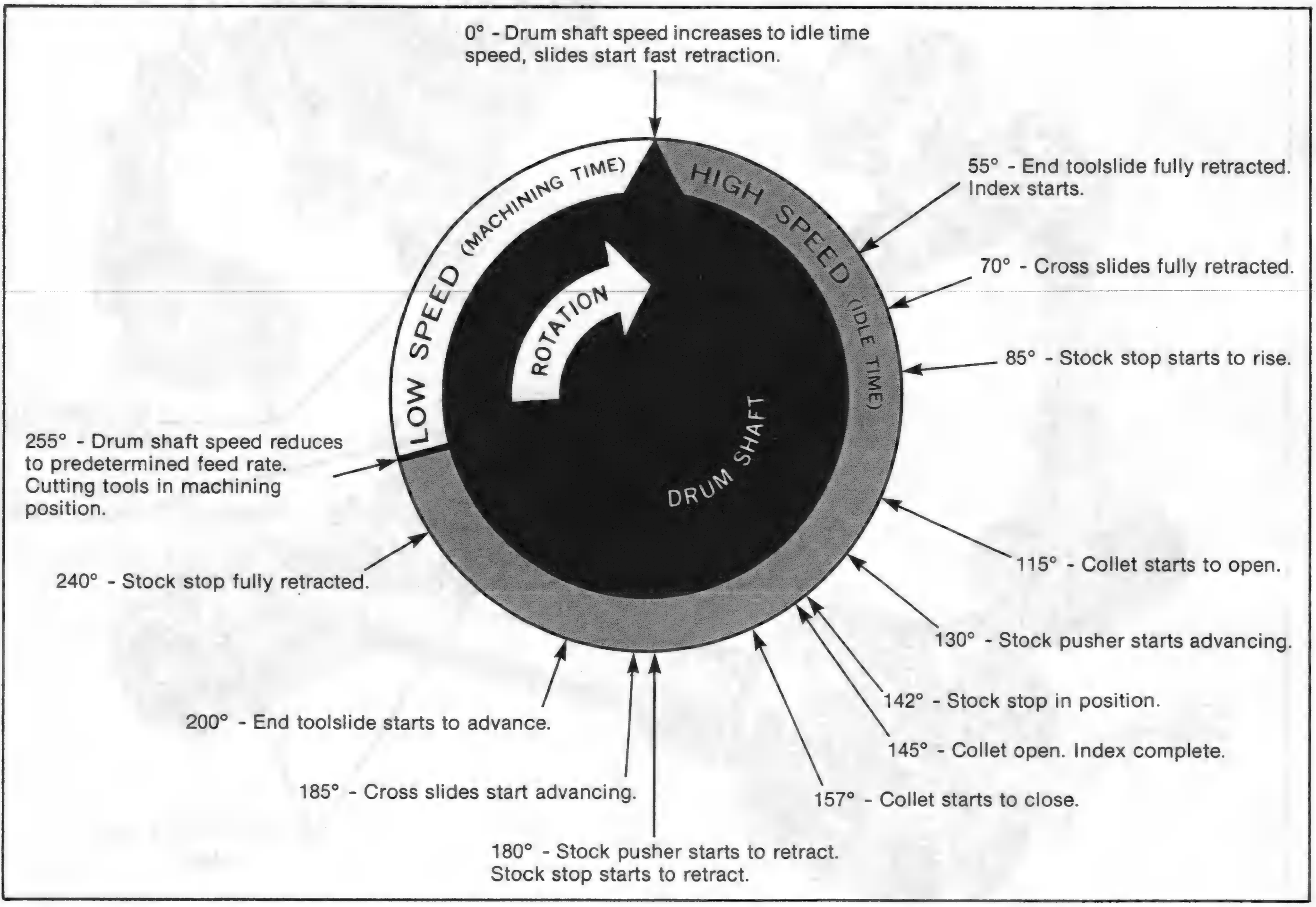

0° - Drum shaft speed increases to idle time speed, slides start fast retraction.
55° - End toolslide fully retracted. Index starts.
70° - Cross slides fully retracted.
85° - Stock stop starts to rise.
115° - Collet starts to open.
130° - Stock pusher starts advancing.
142° - Stock stop in position.
145° - Collet open. Index complete.
157° - Collet starts to close.
180° - Stock pusher starts to retract. Stock stop starts to retract.
185° - Cross slides start advancing.
200° - End toolslide starts to advance.
240° - Stock stop fully retracted.
255° - Drum shaft speed reduces to predetermined feed rate. Cutting tools in machining position.
HIGH SPEED (IDLE TIME)
LOW SPEED (MACHINING TIME)
ROTATION
DRUM SHAFT

Fig. B-5. Operations performed during one complete cycle of the machine. (2⅝" RB-6)

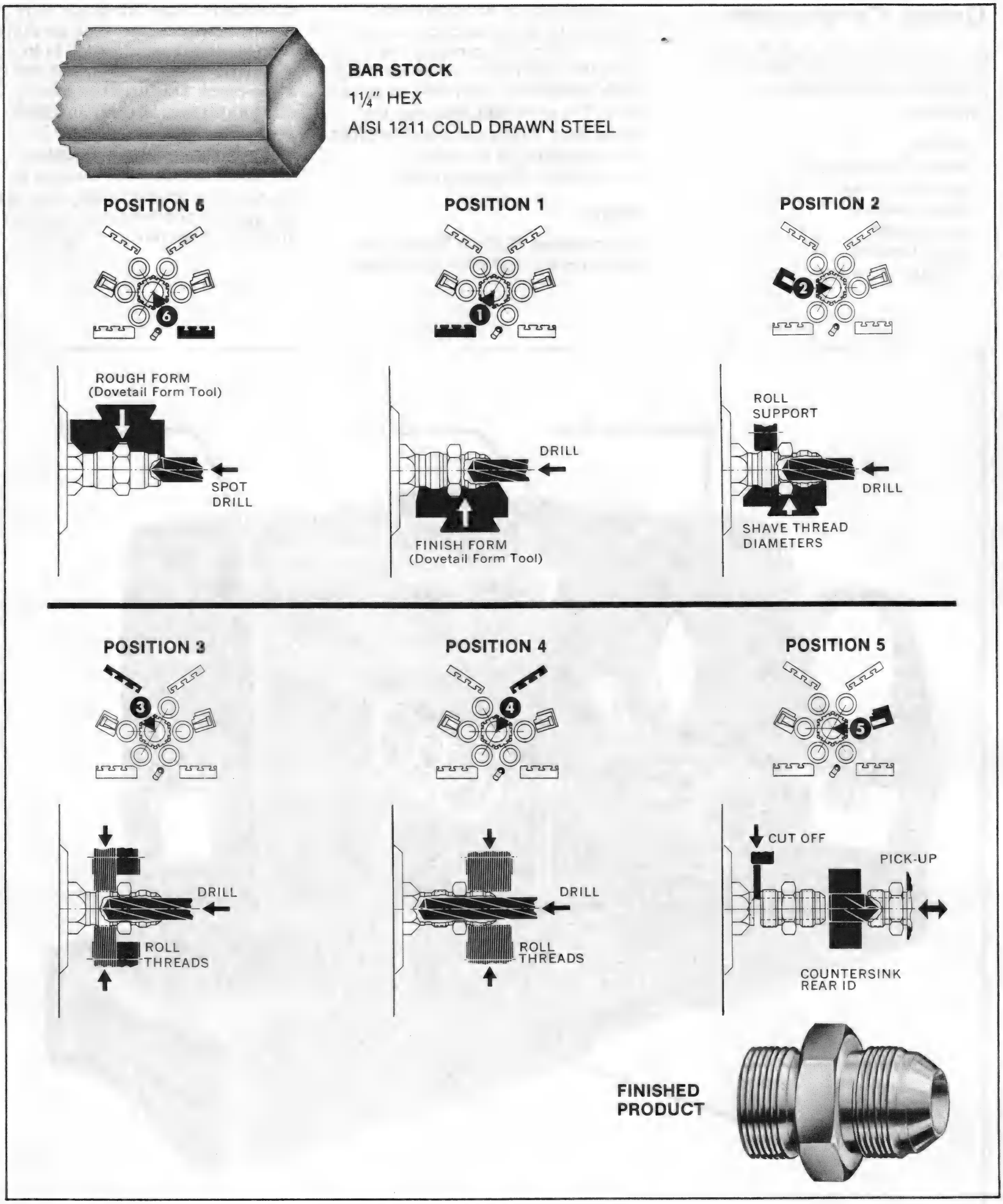

BAR STOCK
1¼" HEX
AISI 1211 COLD DRAWN STEEL
POSITION 6
6
ROUGH FORM
(Dovetail Form Tool)
SPOT
DRILL
POSITION 1
1
DRILL
FINISH FORM
(Dovetail Form Tool)
POSITION 2
2
ROLL
SUPPORT
DRILL
SHAVE THREAD
DIAMETERS
POSITION 3
3
DRILL
ROLL
THREADS
POSITION 4
4
DRILL
ROLL
THREADS
POSITION 5
5
CUT OFF
PICK-UP
COUNTERSINK
REAR ID
FINISHED
PRODUCT

Fig. B-6. Typical machining operations performed during one complete revolution of the spindle carrier. (2" RB-6)

Overall Construction

An Acme-Gridley Multiple Spindle Bar Machine is constructed of a number of sub assemblies or "systems":

- Frame
- Power Transmission
- Spindle Carrier
- Stock Feeding
- Cross Slide
- End Toolslide
- Control

The construction and operation of these systems are described one by one on the following pages. The complete machine assembly with key parts identified is illustrated on page B-22. The schematic drawings that follow page B-22 show the differences in arrangement of the power transmission of various models.

Frame

Acme-Gridley Multiple Spindle Bar Machines are built on a solid frame consisting of four high grade alloy castings that are machined, carefully aligned, bolted and doweled to form an integral unit. (Fig. B-7) The *pan* is a one-piece, heavily ribbed casting that forms the base of the machine. The heavily cross-walled and reinforced *gearbox* and *headstock* are bolted and doweled securely to the *pan*. The one-piece *top plate* ties the gearbox and headstock together and holds them firmly in alignment.

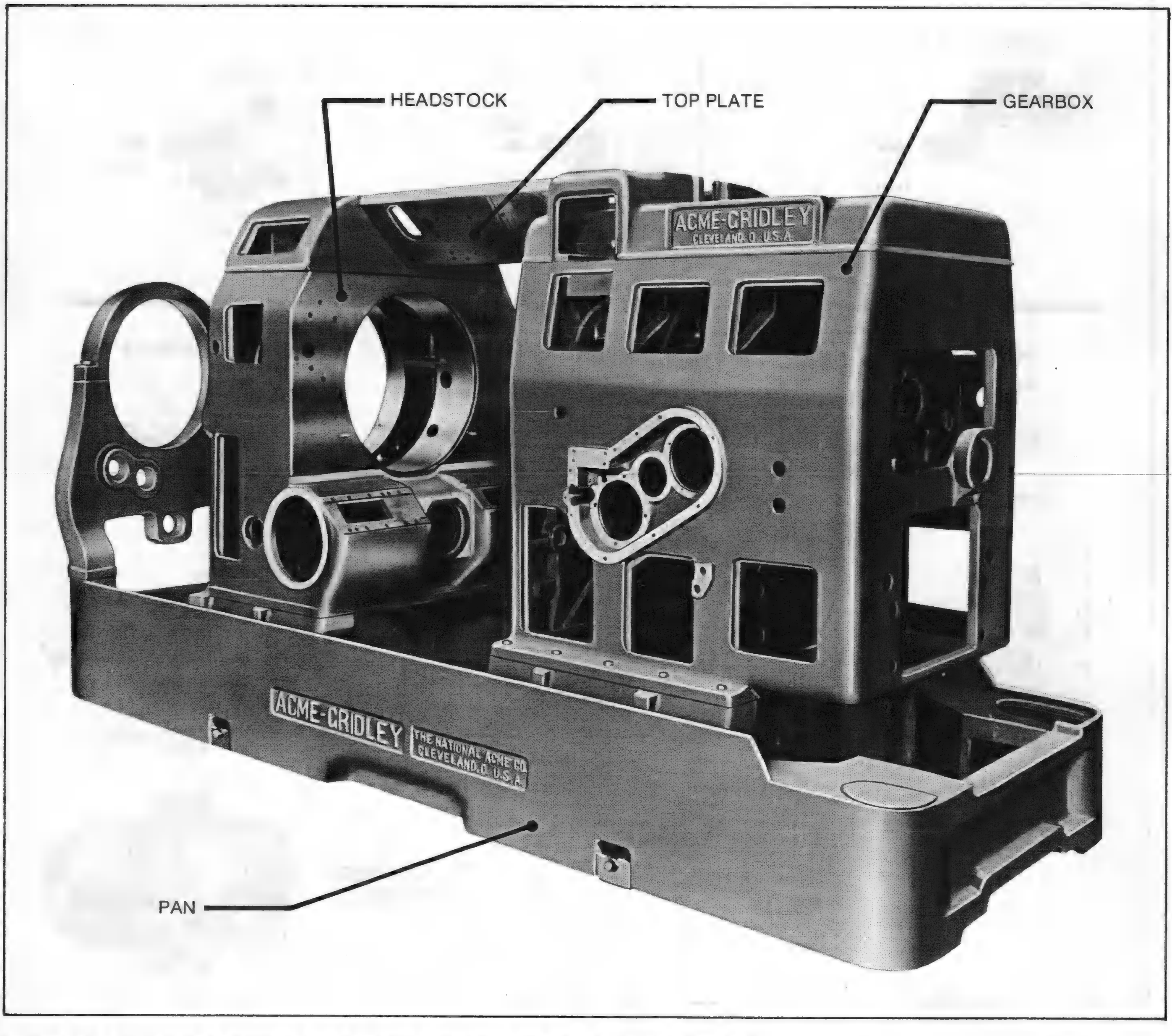


Fig. B-7. The frame consists of four heavy duty machined castings. (2⅝" RB-6)

Power Transmission System

The power transmission system transmits power from the *main drive motor* to all parts of the machine and controls the associated operations. (Fig. B-8) It performs four major functions:

1. Drives the *work spindles* at a preselected constant speed.
2. Drives the *main drum shaft* which activates and synchronizes all machine motions.
3. Drives the *main drum shaft* at two predetermined speeds during each machine cycle: a selected machining speed and a high idle speed.
4. Reverses the direction of rotation of the *main drum shaft* when desired during setup (1¼" RB-8 and larger only).

Power is applied from the *main drive motor* thru the *V-belt drive* to the *pulley shaft.* The *pulley shaft* distributes this incoming power and rotation in two directions:

1. Spindle speed and feed drive.
2. High speed drive (idle time).

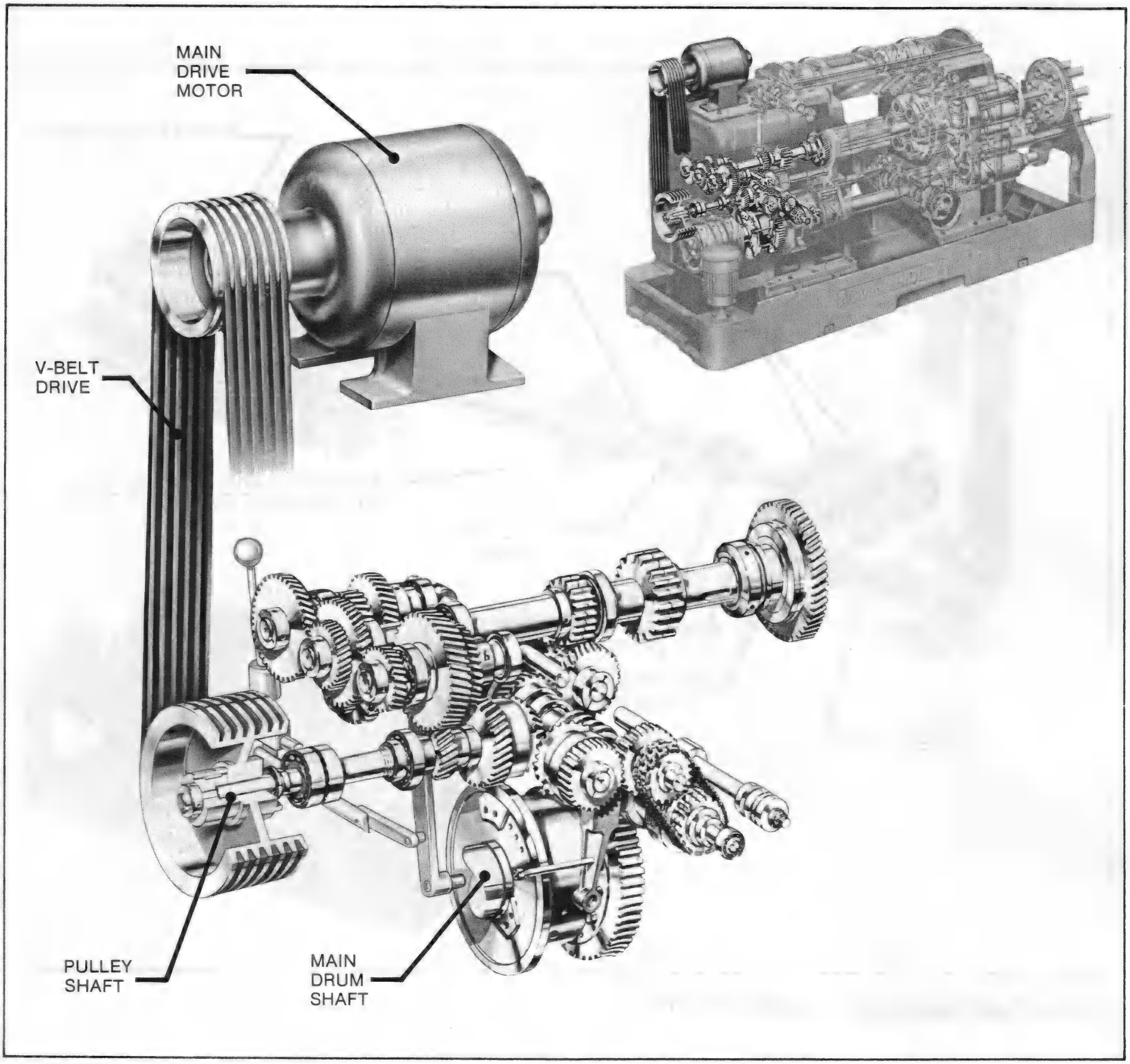


Fig. B-8. Power transmission system. (2⅝" RB-6)

Spindle Speed Drive

Power to drive the *spindles* is transmitted from the *pulley shaft* by a set of *spindle speed range gears* (high or low), *spindle speed change gear shaft, spindle speed change gears, spindle drive shaft, spindle drive gear* and *spindle driven gears* at a constant preselected speed. (Fig. B-9) To obtain a specific spindle speed, *spindle speed range gears* and *spindle speed change gears* must be selected from the gear chart specified for the specific machine being used.

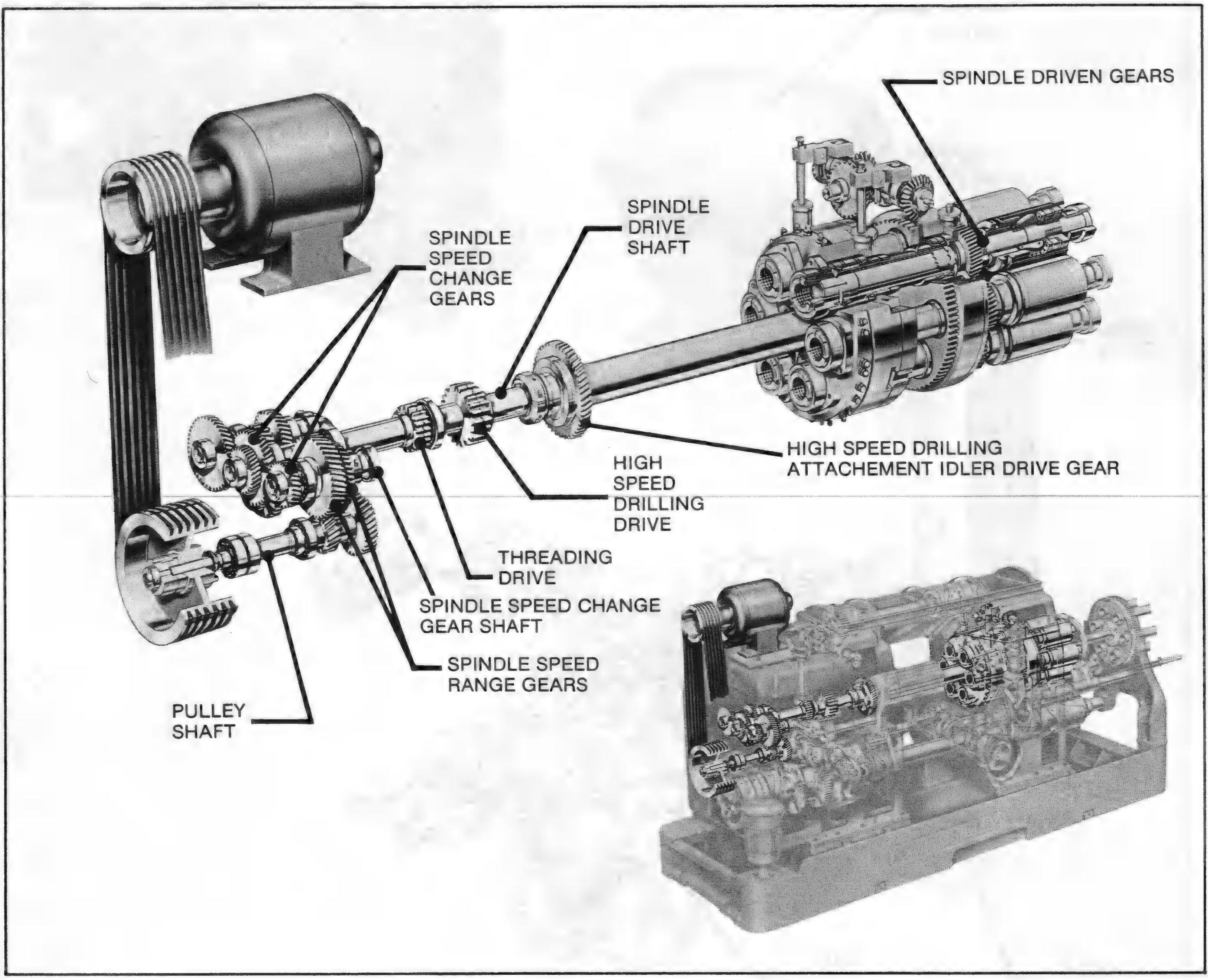

SPINDLE DRIVEN GEARS
SPINDLE DRIVE SHAFT
SPINDLE SPEED CHANGE GEARS
HIGH SPEED DRILLING ATTACHEMENT IDLER DRIVE GEAR
HIGH SPEED DRILLING DRIVE
THREADING DRIVE
SPINDLE SPEED CHANGE GEAR SHAFT
SPINDLE SPEED RANGE GEARS
PULLEY SHAFT

Fig. B-9. Power transmission to spindles. (2$\frac{5}{8}$" RB-6)

The *spindle drive shaft* drives the four, six or eight work spindles through the *spindle drive and driven gears.* (Fig. B-10) It extends from the gearbox through the spindle carrier stem and spindle carrier to the finger holder end of the work spindles.

The *spindle drive shaft* also serves as the drive member for attachments such as high speed drilling, threading, pickup and any other special rotating attachments. (Fig. B-9)

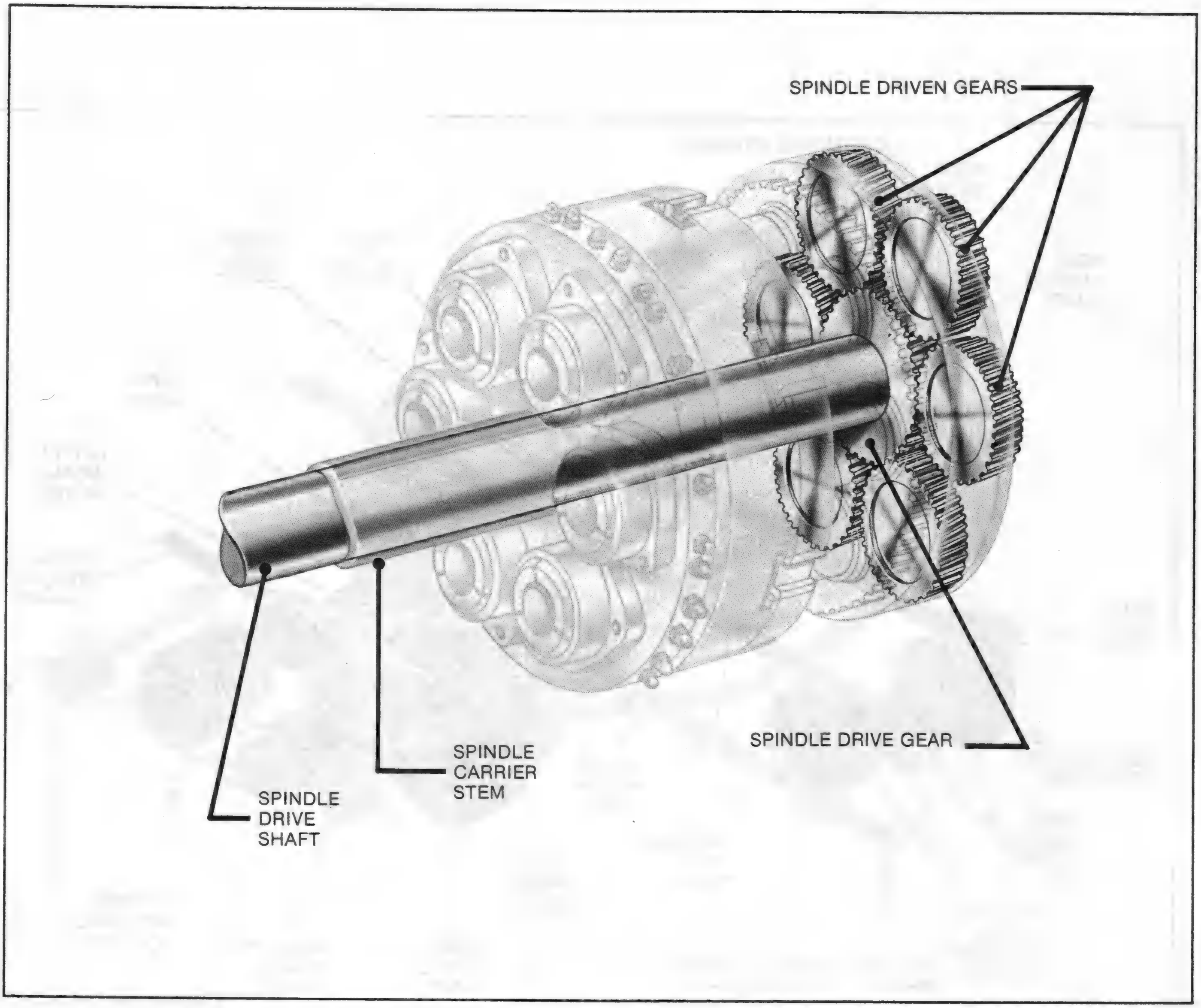

SPINDLE DRIVEN GEARS
SPINDLE DRIVE GEAR
SPINDLE CARRIER STEM
SPINDLE DRIVE SHAFT

Fig. B-10. Spindle drive shaft drives spindle gears. (2⅝" RB-6)

Feed Drive

Power to drive the *main drum shaft,* during the feed portion of a cycle, is taken from the *spindle drive shaft* by a set of *feed change gears* and transmitted thru the *feed change gear shaft, feed range gears* (fine or coarse), *small worm shaft, small worm, small worm wheel, roll clutch shaft, roll clutch* to the *feed clutch.* (Fig. B-11) By engaging the *feed clutch,* power is fed thru the *large worm shaft* to the *large worm* which drives the *large worm wheel* mounted on the *toolslide drum,* driving the *main drum shaft.*

To obtain a specific feed rate, the proper *feed range* and *feed change gears* must be selected from the gear chart specified for the specific machine being used. As the power to drive the *drum shaft* during this portion of the cycle is taken from the *spindle drive shaft,* changes to spindle speed affect machining time but do not affect the feed per revolution (FPR).

Power reverse is a feature used by the operator as an aid in setting up on the 1¼″ RB-8 and larger models. This mechanism is driven from the *constant speed shaft* thru a pair of gears and a chain to reverse the rotation of the *large worm shaft.* The *power reverse clutch* (Fig. B-11) is activated by the *feed reverse switch* on the control panel. See page B-29 for instructions.

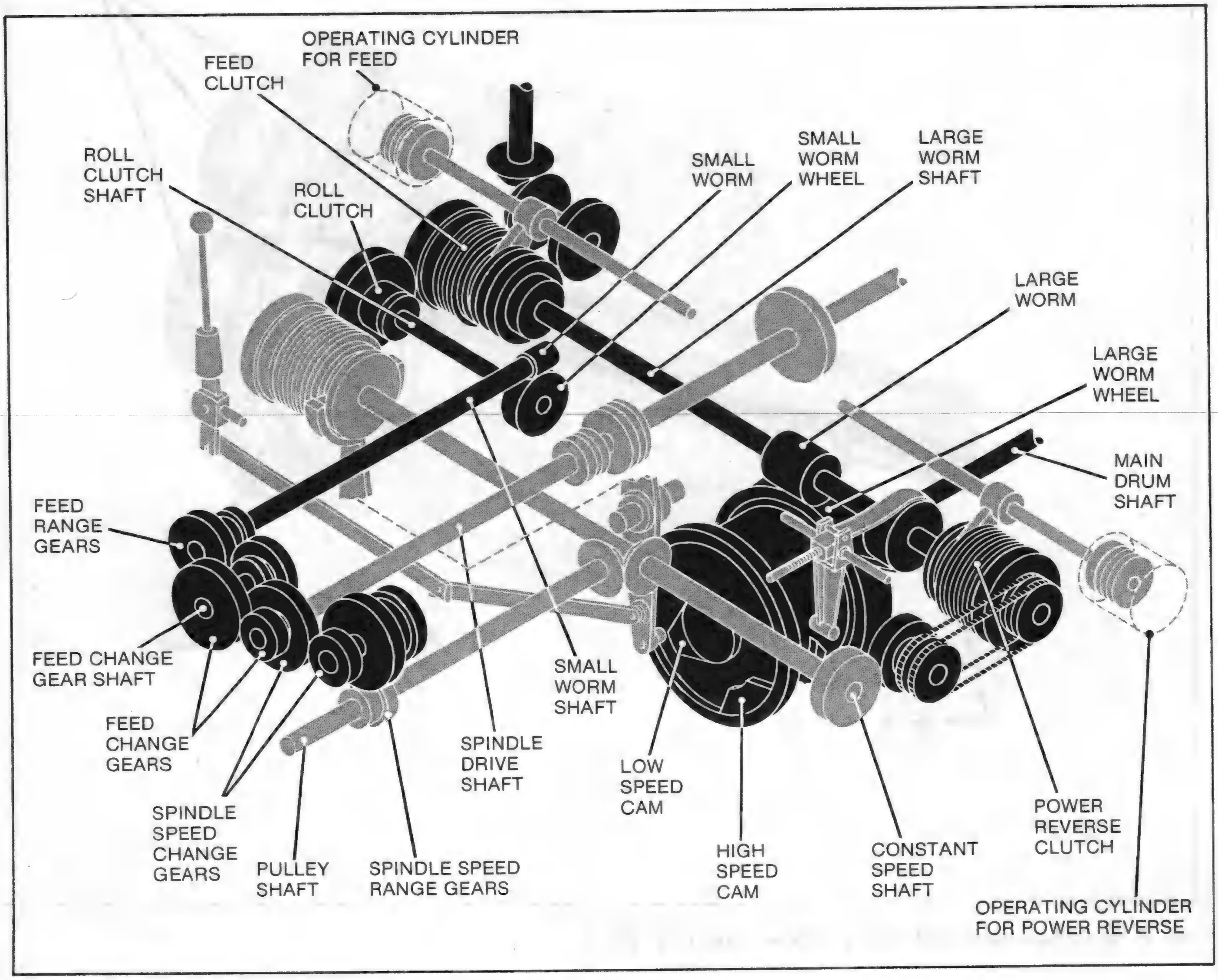

OPERATING CYLINDER FOR FEED
FEED CLUTCH
ROLL CLUTCH SHAFT
ROLL CLUTCH
SMALL WORM
SMALL WORM WHEEL
LARGE WORM SHAFT
LARGE WORM
LARGE WORM WHEEL
MAIN DRUM SHAFT
FEED RANGE GEARS
FEED CHANGE GEAR SHAFT
FEED CHANGE GEARS
SPINDLE SPEED CHANGE GEARS
PULLEY SHAFT
SPINDLE SPEED RANGE GEARS
SMALL WORM SHAFT
SPINDLE DRIVE SHAFT
LOW SPEED CAM
HIGH SPEED CAM
CONSTANT SPEED SHAFT
POWER REVERSE CLUTCH
OPERATING CYLINDER FOR POWER REVERSE

Fig. B-11. Power transmission to main drum shaft during machining time. (2⅝″ RB-6)

High Speed Drive (Idle Time)

Idle time is that portion of the machine cycle where tools are not cutting. It is during this time that other vital machine functions are performed such as: *slides* are retracted, *locking pin* is retracted, *spindle carrier* is indexed, *locking pin* is inserted, *stock stop* is positioned, *collet* is opened, stock is fed to length, *collet* is closed, *stock stop* is retracted and tools are returned to the start of the cut.

To perform these functions in the shortest possible time, the machine is equipped with a separate high speed power transmission for the *main drum shaft.* (Fig. B-12) Power for this function is taken from the *pulley shaft* thru a set of bevel gears to a *constant speed shaft* which drives a *high speed clutch.* The *high speed clutch gear* driven by the high speed clutch is in mesh with the *roll clutch gear* in the *feed drive.* Activating the *high speed clutch* automatically causes it to override the speed of the feed train thru the *roll clutch* to the *feed clutch, large worm shaft, large worm* and *large worm wheel* causing the *main drum shaft* to go into high speed. The *high speed cam* engages the *high speed clutch* mechanically during the cycle and is set to shift the clutch just after the tools have finished cutting.

The machine is now in high speed and stays in this mode until the *low speed cam* disengages the *high speed clutch.* The *brake cam* applies the *brake* momentarily to slow down the *main drum shaft* to the predetermined speed required for the feed drive. The *low speed cam* and *brake cam* are set to slow the machine to the feed rate just before the tools reach the work pieces.

Power to the *main drum shaft* at low speed is again obtained from the feed train at the *roll clutch.* The *main drum shaft* continues to rotate at feed rate until the *high speed cam* again engages the *high speed clutch* and idle time starts once again.

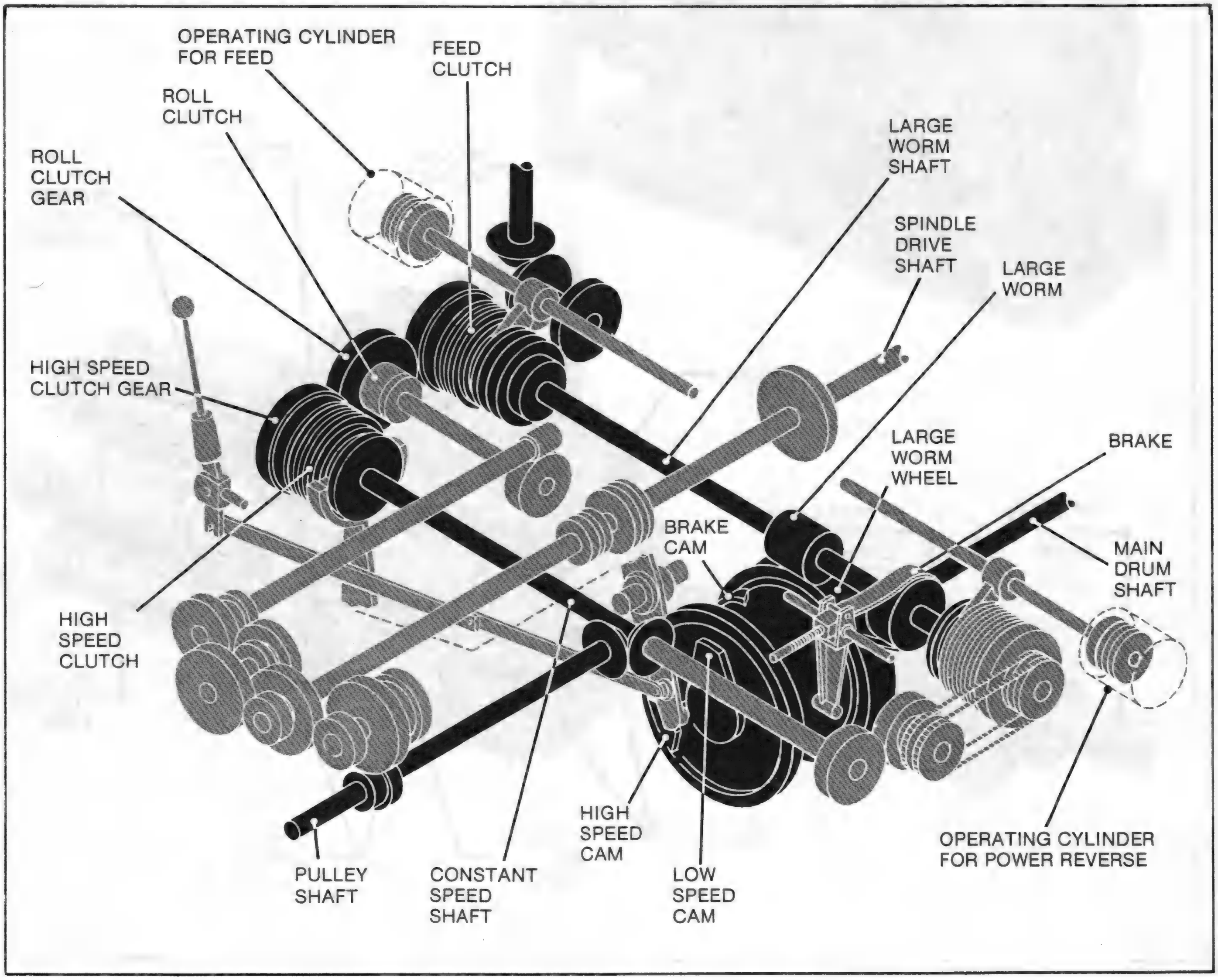

OPERATING CYLINDER FOR FEED
FEED CLUTCH
ROLL CLUTCH
ROLL CLUTCH GEAR
LARGE WORM SHAFT
SPINDLE DRIVE SHAFT
LARGE WORM
HIGH SPEED CLUTCH GEAR
LARGE WORM WHEEL
BRAKE
BRAKE CAM
MAIN DRUM SHAFT
HIGH SPEED CLUTCH
HIGH SPEED CAM
OPERATING CYLINDER FOR POWER REVERSE
PULLEY SHAFT
CONSTANT SPEED SHAFT
LOW SPEED CAM

Fig. B-12. Power transmission to main drum shaft during idle time (high speed). (2⅝" RB-6)

Spindle Carrier System

The spindle carrier system holds and rotates the bar stock as required to achieve the desired machining. (Fig. B-13) It performs four major functions:

1. Receives and holds the four, six or eight bars of stock.
2. Assists in feeding the bars into the machining area one at a time as they reach the stock feed position.
3. Rotates the bars at a constant speed to perform the machining operations.
4. Indexes the bars from position to position so that each bar is progressively machined until the part is finished.

Two wide spindle carrier *journals* housed in the rugged *headstock* frame and a heavy bearing in the gearbox section rigidly supporting the stem end provide a three-point bearing for the carrier system. Precise alignment of the *end toolslide* is permanently retained because of the basic integral carrier and stem construction. The front and rear spindle holes in the *spindle carrier* are equally spaced and bored in line to an accuracy of "tenths of thousandths." Into these holes are fitted precision ground *spindles* mounted in anti-friction bearings which are accurately checked for uniformity.

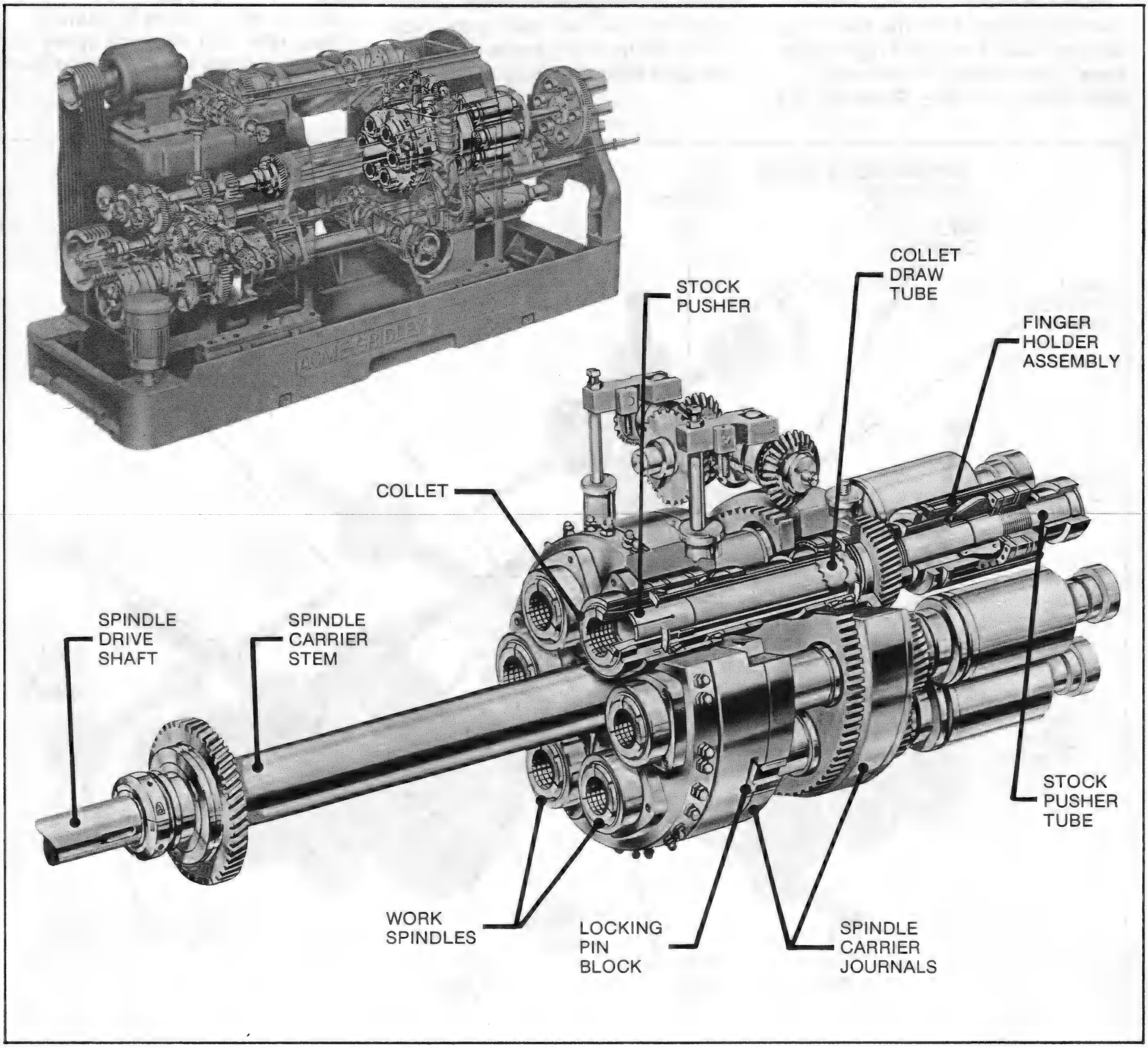

ACME-GRIDLEY
STOCK PUSHER
COLLET DRAW TUBE
FINGER HOLDER ASSEMBLY
COLLET
SPINDLE DRIVE SHAFT
SPINDLE CARRIER STEM
STOCK PUSHER TUBE
WORK SPINDLES
LOCKING PIN BLOCK
SPINDLE CARRIER JOURNALS

Fig. B-13. Spindle carrier system. (2⅝" RB-6)

The complete *spindle carrier* assembly is rotated by the *main drum shaft* thru the Geneva motion of the *indexing mechanism.* (Fig. B-14) As the *main drum shaft* rotates, the rotating *indexing arm* reaches a point where its roll enters an *index slot* in the *index disc,* rotating the *index disc* 90° or one-quarter of a revolution. The ratio of the *index disc gear* and the *carrier index gear* is such that a 90° turn of the *index gear* in turn indexes the *spindle carrier* one position.

At the start of the carrier rotation, the *locking pin lever cam* mounted on the *indexing arm* actuates the *locking pin lever* to pull the *locking pin* out of the *locking pin block* on the *spindle carrier.* This frees the *spindle carrier* so it can be rotated by the *indexing mechanism.* At the end of the *spindle carrier* rotation, the *locking pin lever roll* slides off the *locking pin lever cam* allowing the *locking pin* to engage the next *locking pin block* under pressure from the *locking pin spring.* Each time the spindle carrier reaches the end of one index, it is accurately positioned by the *locking pin* and is locked in position by the *carrier clamping mechanism.*

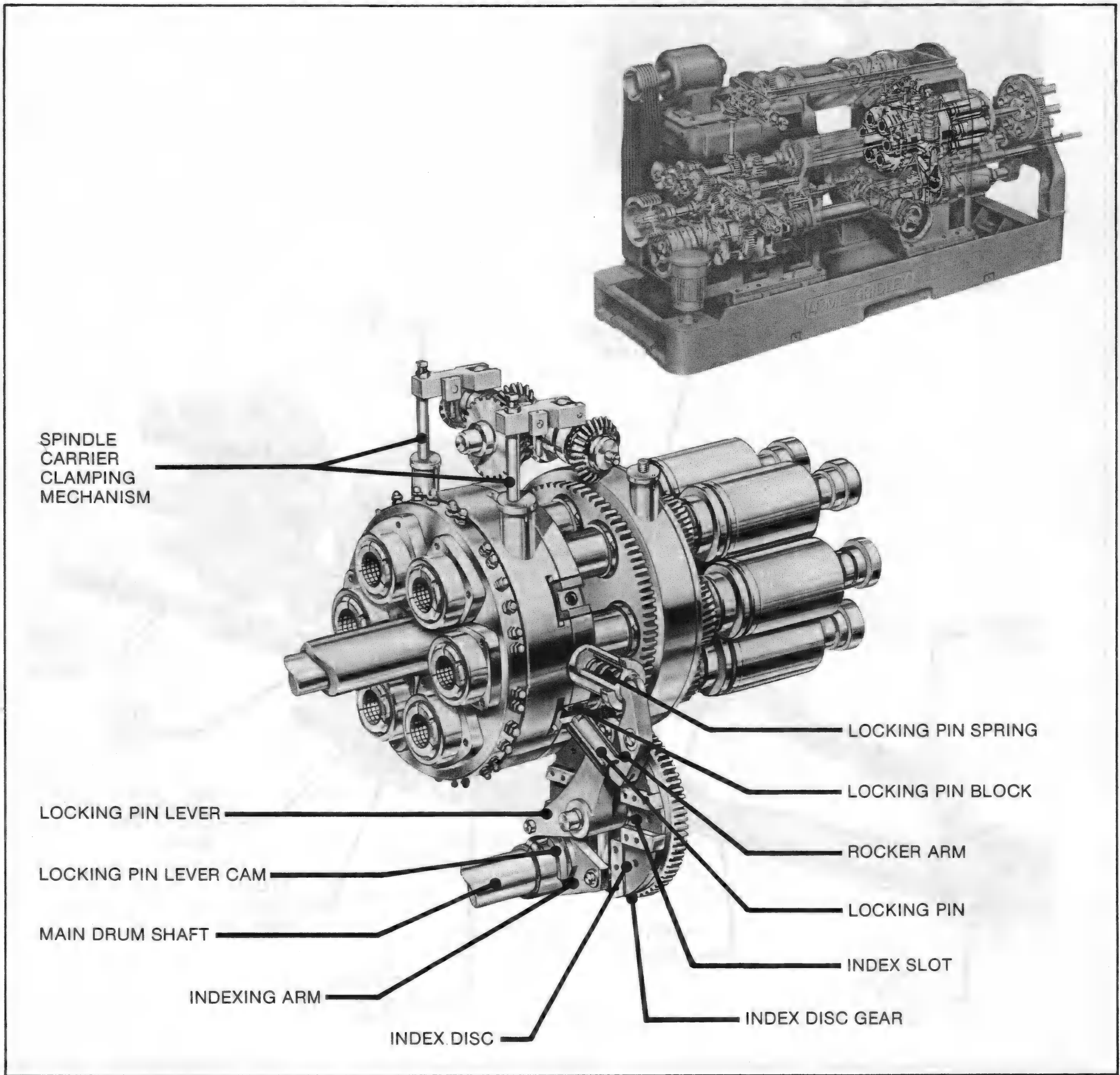

SPINDLE CARRIER CLAMPING MECHANISM
LOCKING PIN SPRING
LOCKING PIN BLOCK
LOCKING PIN LEVER
ROCKER ARM
LOCKING PIN LEVER CAM
LOCKING PIN
MAIN DRUM SHAFT
INDEX SLOT
INDEXING ARM
INDEX DISC GEAR
INDEX DISC

Fig. B-14. Spindle carrier indexing and locking mechanism. (2⅝" RB-6)

Stock Feeding System

Each time a *spindle* reaches the stock feed position, the proper length of bar is fed into the machining area. (Fig. B-15) The sequence starts with the *stock stop* moving into positon followed by the *collet* opening, the bar being fed forward until it contacts the *stock stop*, the *collet* closing and the *stock stop* retracting. Three sets of cams — *stock stop*, *collet operating* and *stock feed* — provide these motions.

As the *main drum shaft* rotates, the *stock stop cam* raises the *stock stop* into position in front of the *work spindle*. At the same time, the *collet opening cam* moves the *collet operating slide* forward, releasing the *collet* so it can open under its own

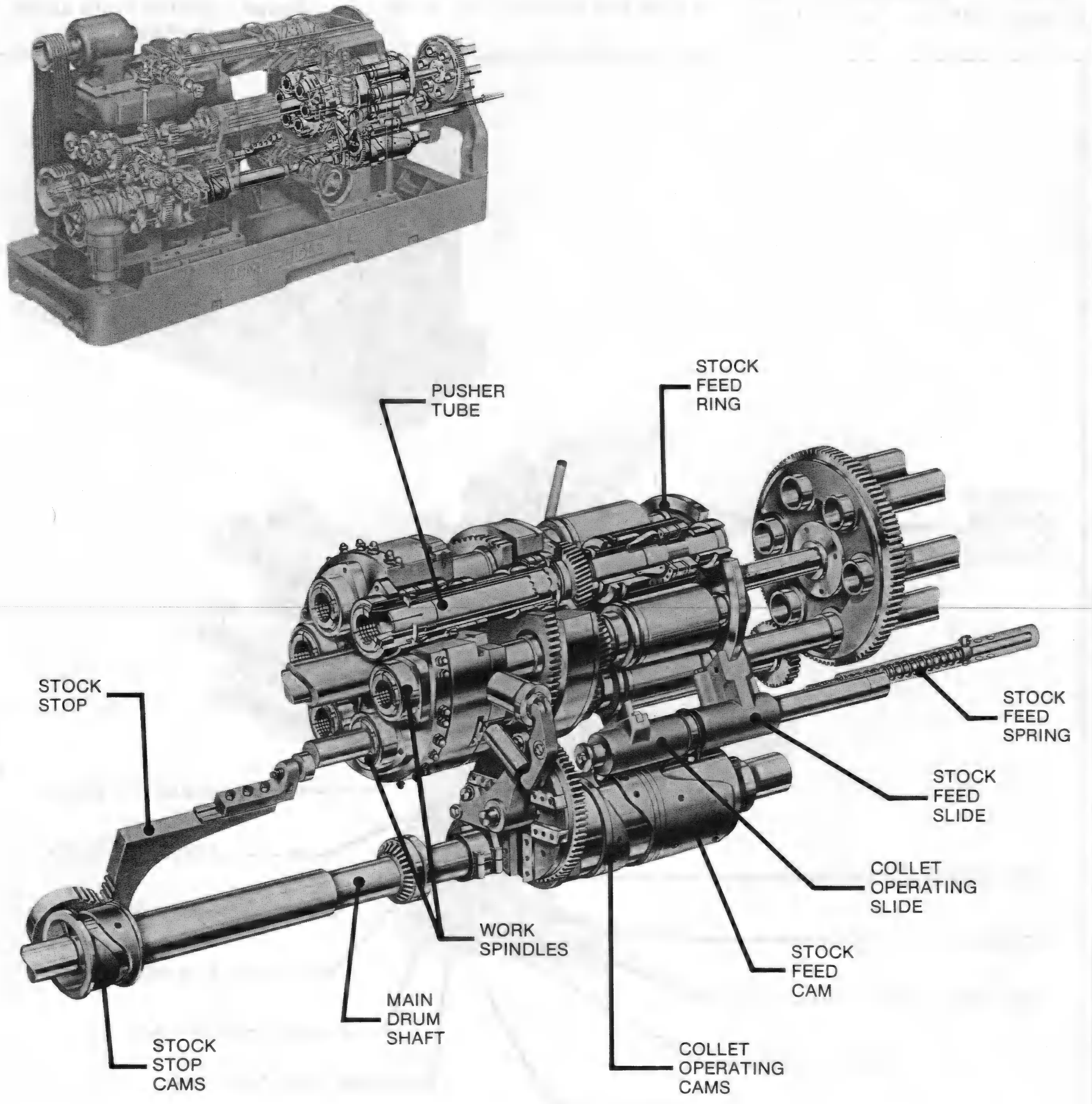
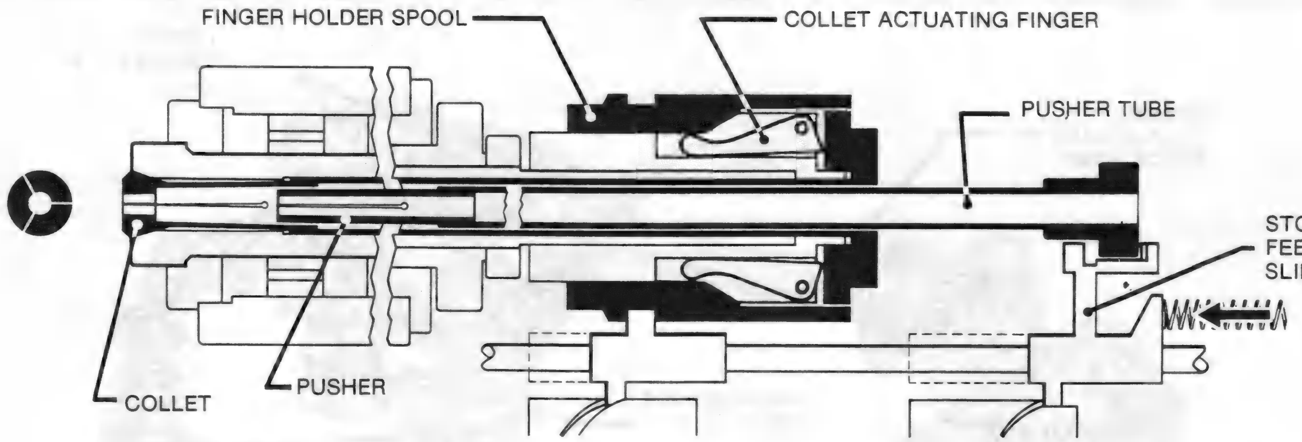

PUSHER TUBE
STOCK FEED RING
STOCK STOP
STOCK FEED SPRING
STOCK FEED SLIDE
COLLET OPERATING SLIDE
WORK SPINDLES
STOCK FEED CAM
MAIN DRUM SHAFT
STOCK STOP CAMS
COLLET OPERATING CAMS

Fig. B-15. Collet operating and stock feed system. (2⅝" RB-6)

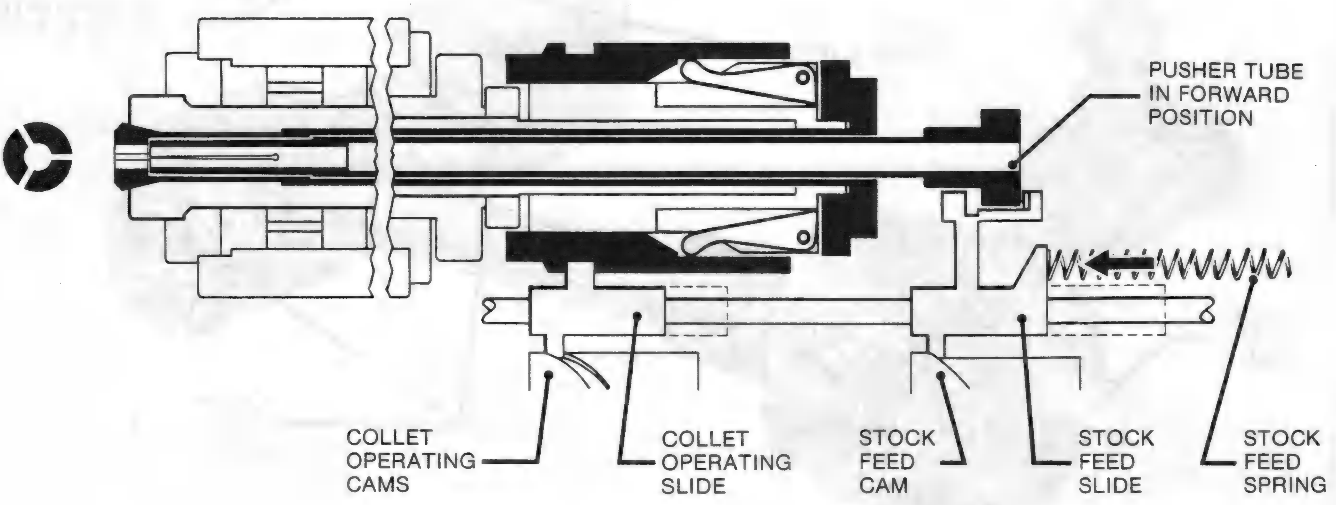
spring pressure. (Fig. B-16) With the bar free to move, the *stock feed cam* releases the *stock feed slide* so it can be pushed forward by the *stock feed spring*. The *stock feed slide,* in turn, pushes the *pusher tube* with the bar of stock forward until the bar contacts the *stock stop.*

The *collet closing cam* then retracts the *collet operating slide,* closing the *collet* so it holds the bar in the forward position. With the *collet* firmly gripping the bar stock, the *stock stop cam* retracts the *stock stop,* positioning it out of the way of end-working tools in that position. At the same time, the *stock feed return cam* starts to retract the *stock feed slide* locating it in position ready to feed the next bar.

All machine sizes up to and including the $1\frac{1}{4}$" RA-6 are equipped with *pneumatic stock depletion* stock stops. This stock stop is arranged thru a series of valves and switches to stop the machine when a bar is not fed to full length. This is a valuable instrument in preventing a run of short pieces and an aid to the operator in indicating to him that the machine is out of stock. These units are also available for all other models of machine. Refer to the electrical diagram of the specific machine for details on setup and operation of the *pneumatic stock depletion device.* Refer to Appendix, section H, page 12.


FINGER HOLDER SPOOL
COLLET ACTUATING FINGER
PUSHER TUBE
STOCK FEED SLIDE
COLLET
PUSHER

COLLET CLOSED


PUSHER TUBE IN FORWARD POSITION
COLLET OPERATING CAMS
COLLET OPERATING SLIDE
STOCK FEED CAM
STOCK FEED SLIDE
STOCK FEED SPRING

COLLET OPEN

Fig. B-16. Stock feed system. ($2\frac{5}{8}$" RB-6)

Cross Slide System

The cross slide system provides the means to mount, advance and retract the tools used in machining operations where motion perpendicular to the axis of the bar is required such as to form, shave, skive, cutoff, etc. (Fig. B-17) Each surface is provided with a set of T-slots to accurately position and secure toolholders. Provision is also made for an *adjusting screw* to simplify adjusting the toolholders laterally on the slide. Four-spindle machines have four standard *cross slides* with two optional auxiliary slides. Six-spindle machines have five standard *cross slides* with one optional slide. Eight-spindle machines have six standard *cross slides.*

The *cross slides* in the lowest position on each side of the machine are referred to as *lower cross slides.* The *cross slides* in the highest position on each side of the machine are referred to as *upper cross slides.* The *cross slides* in between, if any, are called *intermediate cross slides.* Each *cross slide* operates independently of all other *cross slides.*

The motion of the *cross slides* is controlled by independent *cross slide cams* for each position. The amount of lead on these cams is determined by the nature of the specific part being manufactured. The feed rate is a function of the lead selected in combination with the *feed change* and *feed range gears.*

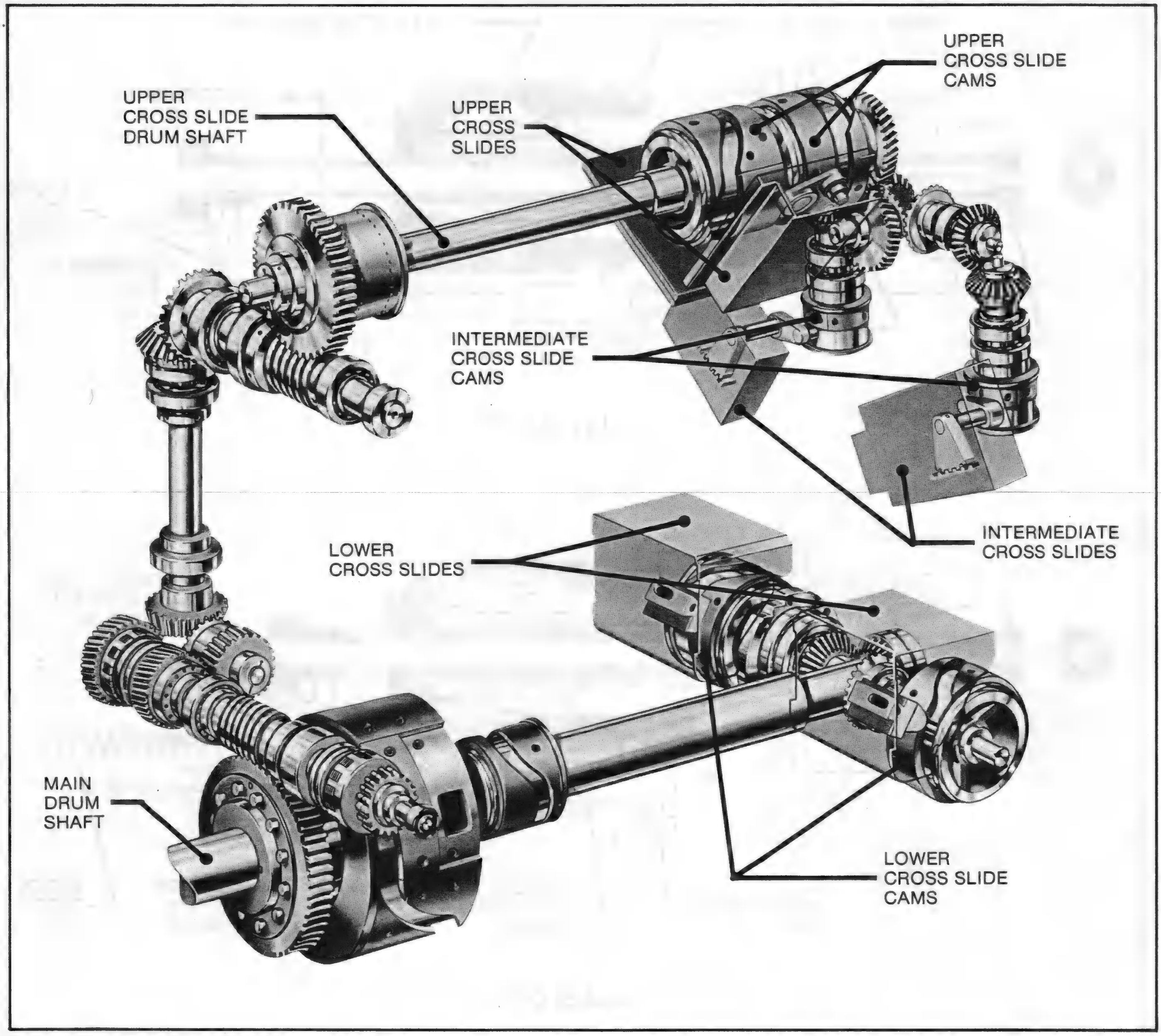

UPPER CROSS SLIDE CAMS
UPPER CROSS SLIDE DRUM SHAFT
UPPER CROSS SLIDES
INTERMEDIATE CROSS SLIDE CAMS
INTERMEDIATE CROSS SLIDES
LOWER CROSS SLIDES
MAIN DRUM SHAFT
LOWER CROSS SLIDE CAMS

Fig. B-17. Cross slide system. (2⅝" RB-6)

The *lower cross slides* are operated by the *lower cross slide cams* mounted on drums which are driven by the *main drum shaft* thru bevel gears. The *upper cross slides* can be direct cam or lever operated. When direct cam operated, the *upper cross slides* are operated by the *upper cross slide cams* which are mounted on the *upper cross slide drums.* (Fig. B-17) The power train starts at the *main drum shaft* and proceeds thru a series of gears and shafts to the *upper cross slide drum shaft.* On machine models having lever operated *upper cross slides,* cams to operate these levers are mounted on the same drums that hold the *lower cross slide cams.* The inside cams operate the *lower cross slides* and the outside cams operate the *upper cross slides* thru the associated levers. (Fig. B-18)

The *intermediate cross slides* can also be direct cam or lever operated. When direct cam operated, the *intermediate cross slides* are operated by the *intermediate cross slide cams* which are mounted on the *intermediate cross slide drums.* (Fig. B-17) The power train picks up at the end of the *upper cross slide drum shaft* and proceeds thru a series of gears to the *intermediate cross slide drums.*

On machine models where the *intermediate cross slides* are lever operated, the slides are operated by a series of levers which are activated by *disc cams* mounted on gears. These gears are driven by a gear on the *main drum shaft* just forward of the *hand chucking drum.* (Fig. B-18)

Each *cross slide* is equipped with a *cross slide stop screw* that is adjustable. Each *cross slide stop screw* contacts a corresponding *carrier stop screw* located on the outer edge of the *spindle carrier.* (Fig. B-19) Each *cross slide stop screw* is adjusted at high point of the *cross slide cam* so the cam follower is held against the feed cam. *Carrier stop screws* should not be disturbed unless absolutely necessary. For setting or adjustment, refer to Appendix, section H, page H-9.

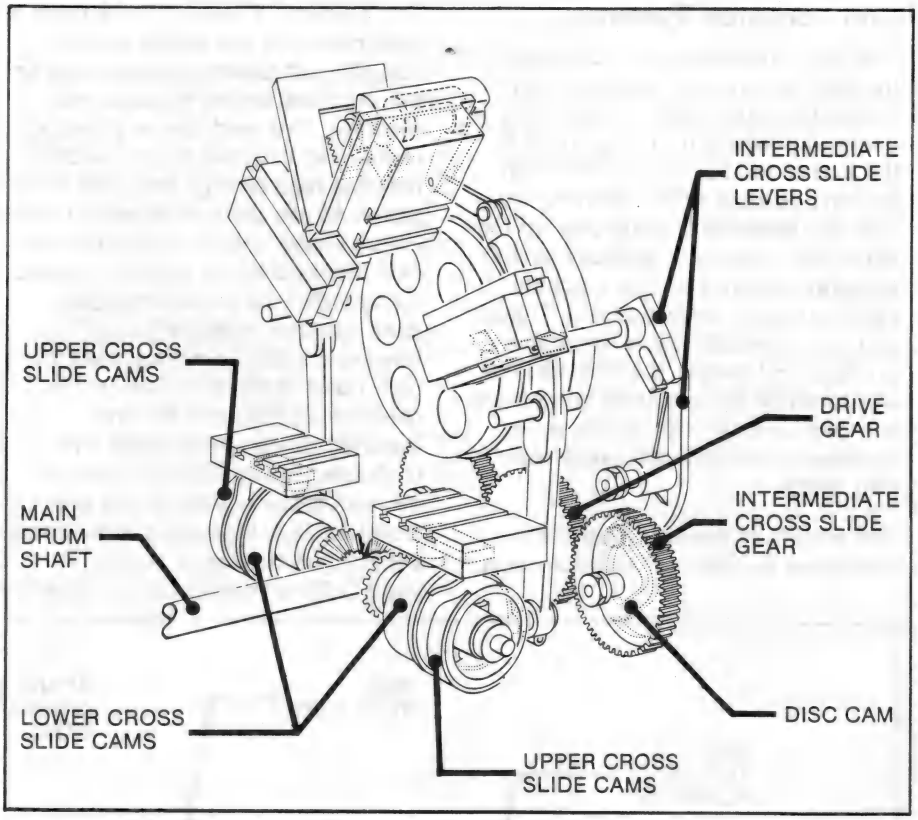


Fig. B-18. Upper and intermediate cross slides are lever operated on some machines.

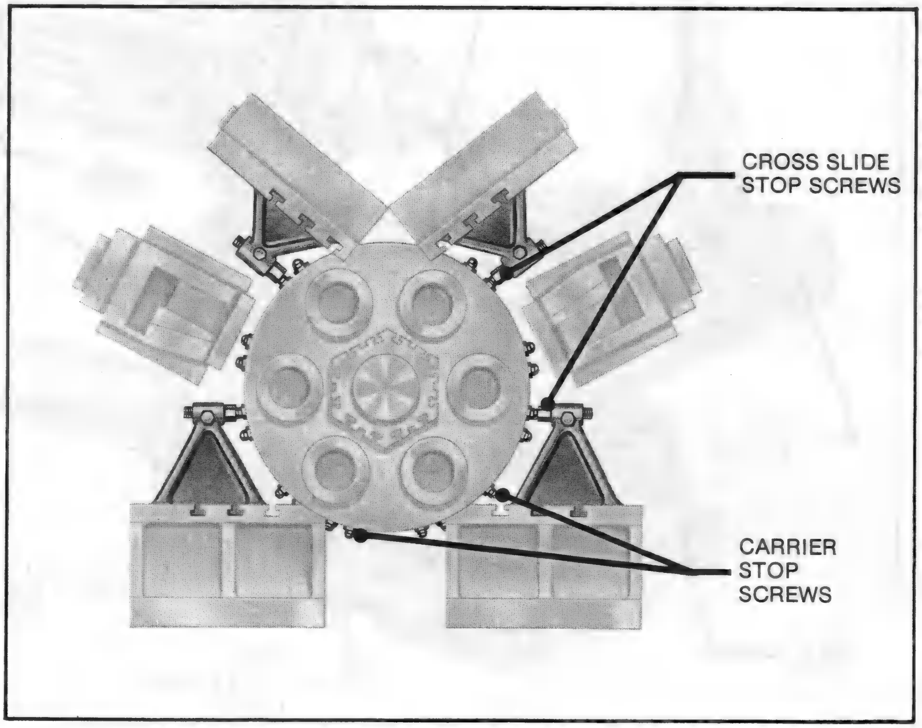


Fig. B-19. Arrangement of cross slide stop screws and carrier stop screws.

End Toolslide System

The end toolslide system provides the means to mount, advance and retract the tools used in machining operations where motion parallel to the axis of the bar is required such as drills, turning tools, reamers, etc. The *end toolslide* is equipped with as many tool mounting surfaces as there are *work spindles* on the machine. Each surface is provided with T-slots and/or a dovetail way to accurately position and secure toolholders. The *end toolslide* is supported and held in line permanently with all the *work spindles* by the *spindle carrier stem.* (Fig. B-20)

The motion of the *end toolslide* is controlled by the *end toolslide cams.* The amount of lead on these cams is determined by the nature of the specific part being manufactured on the machine and/or the feed rate required. The feed rate is a function of the lead selected in combination with the *feed change* and *feed range gears.* As the *main drum shaft* rotates in low speed, the *end toolslide lead cam* moves the *end toolslide* toward the *spindles* via the *end toolslide push rod* and *toolslide guide.* This forward motion continues until the high point of the *toolslide cam* is reached. At this time the *end toolslide guide* contacts the *end toolslide positive stop nut,* holding the cam follower against the *end toolslide cam,* insuring a high repeat accuracy. (See Setup, section D, page D-25 for details on end toolslide master stop pressure settings.) At the end of the machining time, the *drum shaft* shifts into high speed and the *end toolslide return cam* retracts the *end toolslide,* permitting the spindle carrier indexing and stock feed operations to take place.

Cam Identification

THREADING AND ACCELERATED ATTACHMENT CAMS (1) operate the independent die slide of reaming, threading, tapping or accelerated attachments. Long and short length cams in degrees are available for all standard feeds and thread leads (short length cams are used in cutoff positions). For data required to order reaming cams, refer to Appendix, section H, page 11.

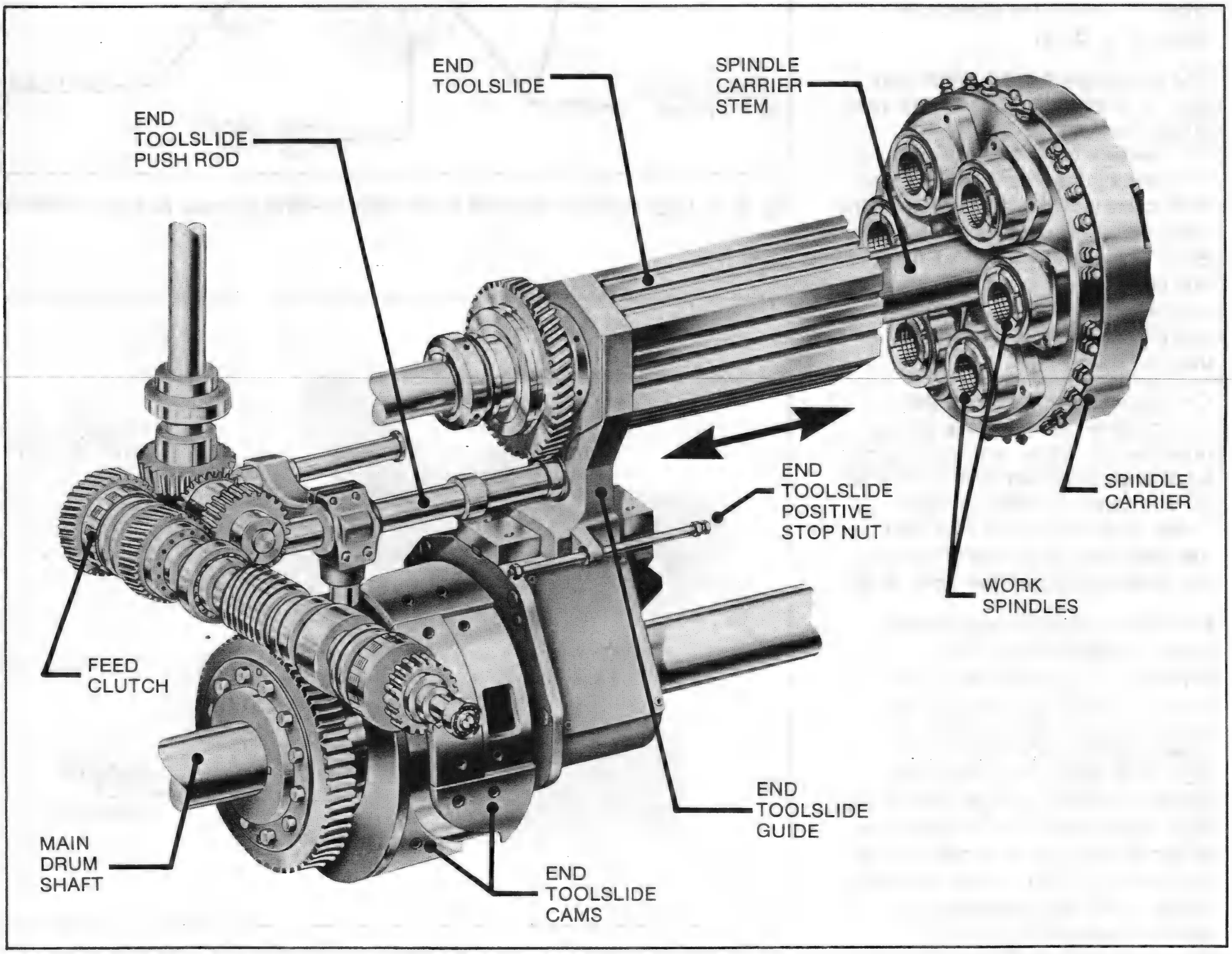


Fig. B-20. End toolslide system. (2⅝" RB-6)

POSITIVE LEAD THREADING CAMS (2 and 3) operate the same as the *threading and accelerated attachment cams.* These cams are designed to specific requirements. For data required to design a positive lead threading cam, refer to Appendix, section H, page 10.

*HIGH SPEED CAM (4) engages the *high speed clutch,* causing the *main drum shaft* to rotate at high speed during idle time.

*LOW SPEED CAM (5) disengages the *high speed clutch* so that the *main drum shaft* can rotate at low speed during machining time.

THREADING CLUTCH OPERATING CAMS (6 or 16) operate the mechanical *threading clutch* for universal threading attachments. One cam trips the *clutch* into high speed and the other into low speed. These cams are timed by adjustment on their drum.

*BRAKE CAM (7) momentarily applies the *brake* on the *large worm shaft* just after the *high speed clutch* has been disengaged, slowing the *main drum shaft* to the machining speed.

END TOOLSLIDE CAM (8) operates the *end toolslide,* causing it to advance and retract as required by the machining and idle times of the complete machine cycle. Precision cams are available in a complete range of leads for each size machine. (Two-piece toolslide lead cams are standard for large machines. Refer to Appendix, section H, page 10.) Optional travel cams are available for specific applications.

STOCK STOP CAM (9) operates the *stock stop* that controls the length of bar stock extending from the *work spindle* as it is fed into the machining area.

LOWER CROSS SLIDE CAMS (10) operate the two *lower cross slides.* There is a separate set of cams for each *lower cross slide.*

HAND CHUCKING SAFETY CAM (11) assures that the *collet* is closed in the hand chucking position prior to indexing.

COLLET OPERATING CAMS (12) consist of a set of three cams: *collet opening, collet closing* and *collet safety cams.* The *collet opening cam* opens the *collet* in the stock feed position so a proper length of bar may be pushed into the machining area. The *collet closing cam* closes the *collet* when the bar has made contact with the *stock stop.*

STOCK FEED CAMS (13) operate the *stock feed slide* which releases and compresses the *stock feed spring,* causing the *pusher* and *pusher tube* to advance and retract. Three standard sets of cams for three different travel lengths are available. Optional sets of cams for other feed lengths are available.

INTERMEDIATE CROSS SLIDE CAMS (14) operate the *intermediate cross slides.* There is a separate set of cams for each intermediate cross slide.

UPPER CROSS SLIDE CAMS (15) operate the two *upper cross slides.* There is a separate set of cams for each upper cross slide.

*High speed, low speed, and brake cams are set at the factory but may require resetting to meet special conditions. For setting instructions, refer to Maintenance, section F, pages 16 and 17.

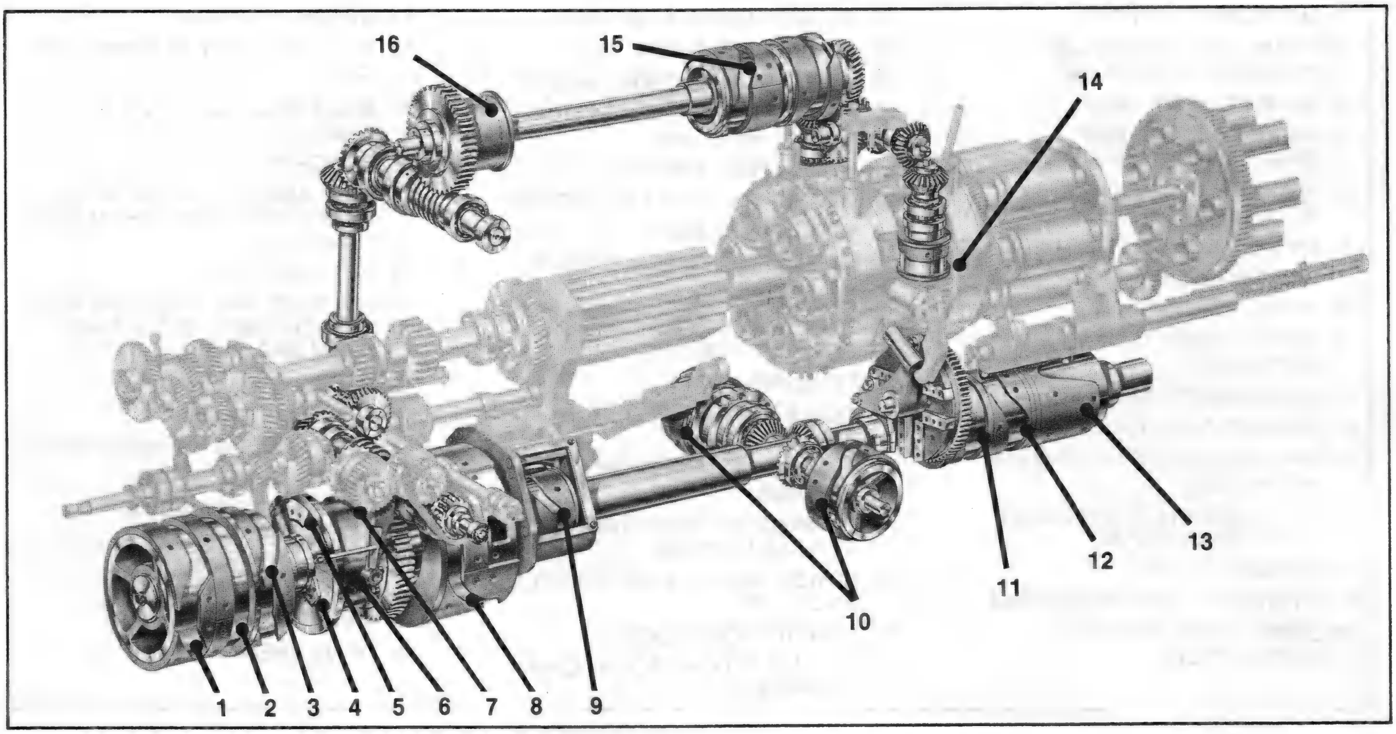
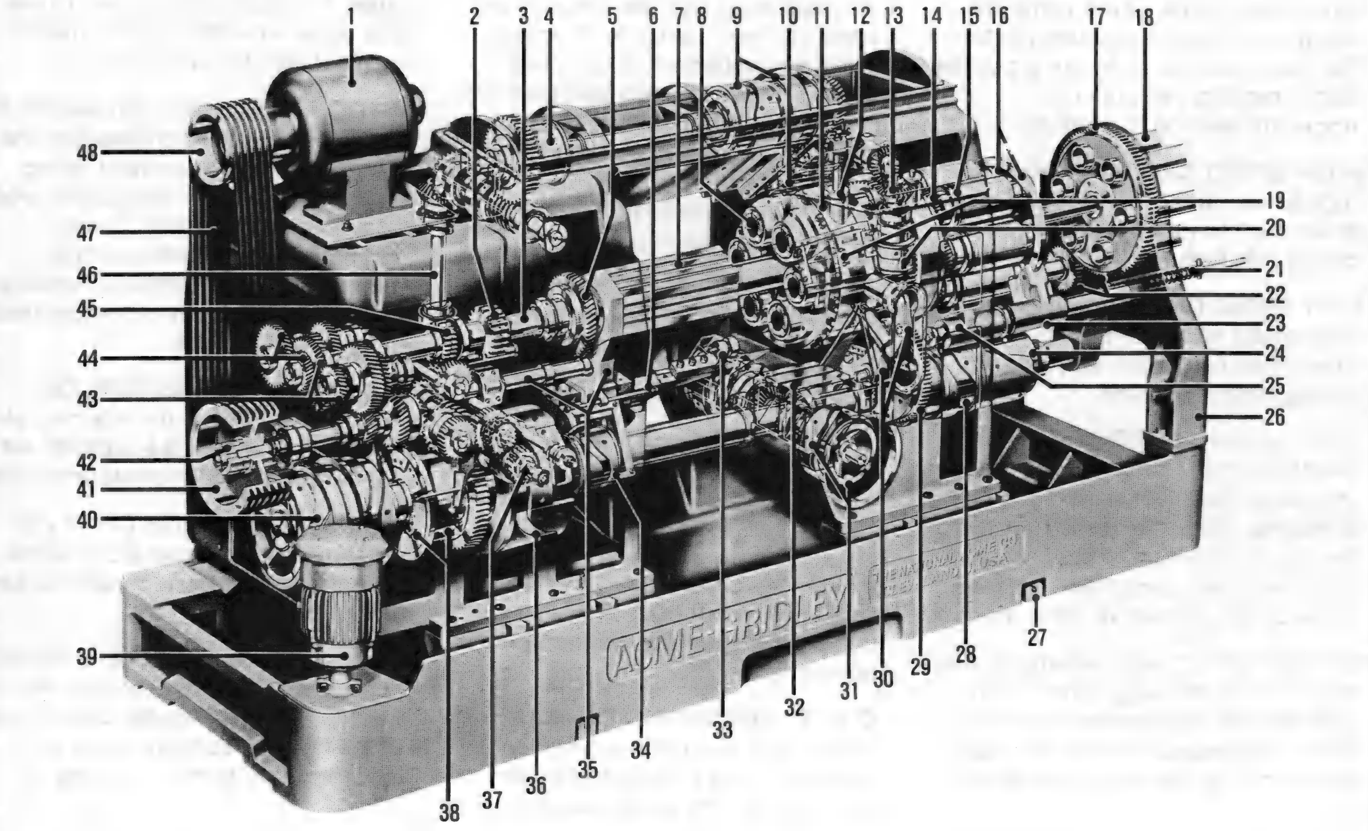


Fig. B-21. Cam locations on $2^5/_8$" RB-6 machine.

Component Identification



1. MAIN DRIVE MOTOR
2. DRIVE FOR HIGH SPEED DRILLING ATTACHMENT
3. SPINDLE DRIVE SHAFT
4. THREADING CLUTCH OPERATING DRUM AND CAMS
5. HIGH SPEED DRILLING ATTACHMENT IDLER DRIVE GEAR
6. END TOOLSLIDE POSITIVE STOP
7. END TOOLSLIDE
8. WORK SPINDLES
9. UPPER CROSS SLIDE DRUMS AND CAMS
10. UPPER CROSS SLIDES
11. SPINDLE CARRIER
12. SPINDLE CARRIER CLAMPING MECHANISM
13. INTERMEDIATE CROSS SLIDE DRUM DRIVE GEARS
14. SPINDLE GEARS
15. FINGER HOLDER MECHANISM
16. STOCK FEED RING AND ALIGNING DISC
17. STOCK REEL GEARED RING
18. STOCK REEL TUBES
19. INTERMEDIATE CROSS SLIDES
20. INTERMEDIATE CROSS SLIDE DRUMS AND CAMS
21. STOCK FEED SPRING
22. STOCK REEL INDEXING GEARS
23. STOCK FEED SLIDE
24. STOCK FEED CAM AND DRUM
25. CHUCKING SLIDE
26. STOCK FEED SHAFT SUPPORT HOUSING
27. LEVELING JACK
28. COLLET OPERATING DRUM AND CAMS
29. INDEXING GEAR FOR SPINDLE CARRIER
30. LOCKING PIN AND LEVER FOR SPINDLE CARRIER
31. LOWER CROSS SLIDE DRUMS AND CAMS
32. LOWER CROSS SLIDES
33. SLIDING STOCK STOP — CAM OPERATED
34. STOCK STOP CAM
35. END TOOLSLIDE PUSHER AND GUIDE
36. END TOOLSLIDE DRUM AND CAMS
37. POWER REVERSE
38. HIGH AND LOW SPEED AND BRAKE OPERATING DRUM AND CAMS
39. COOLANT PUMP
40. DIE SLIDE AND ACCELERATED ATTACHMENTS OPERATING DRUM AND CAMS
41. DRIVEN SHEAVE
42. SHEAR PIN SAFETY
43. SPINDLE SPEED CHANGE GEARS
44. FEED CHANGE GEARS
45. DRIVE FOR THREADING ATTACHMENT
46. DRIVE FOR UPPER DRUM SHAFT
47. V-BELT DRIVE
48. DRIVE SHEAVE

Fig. B-22. Main components of the 2⅝″ RB-6 machine.

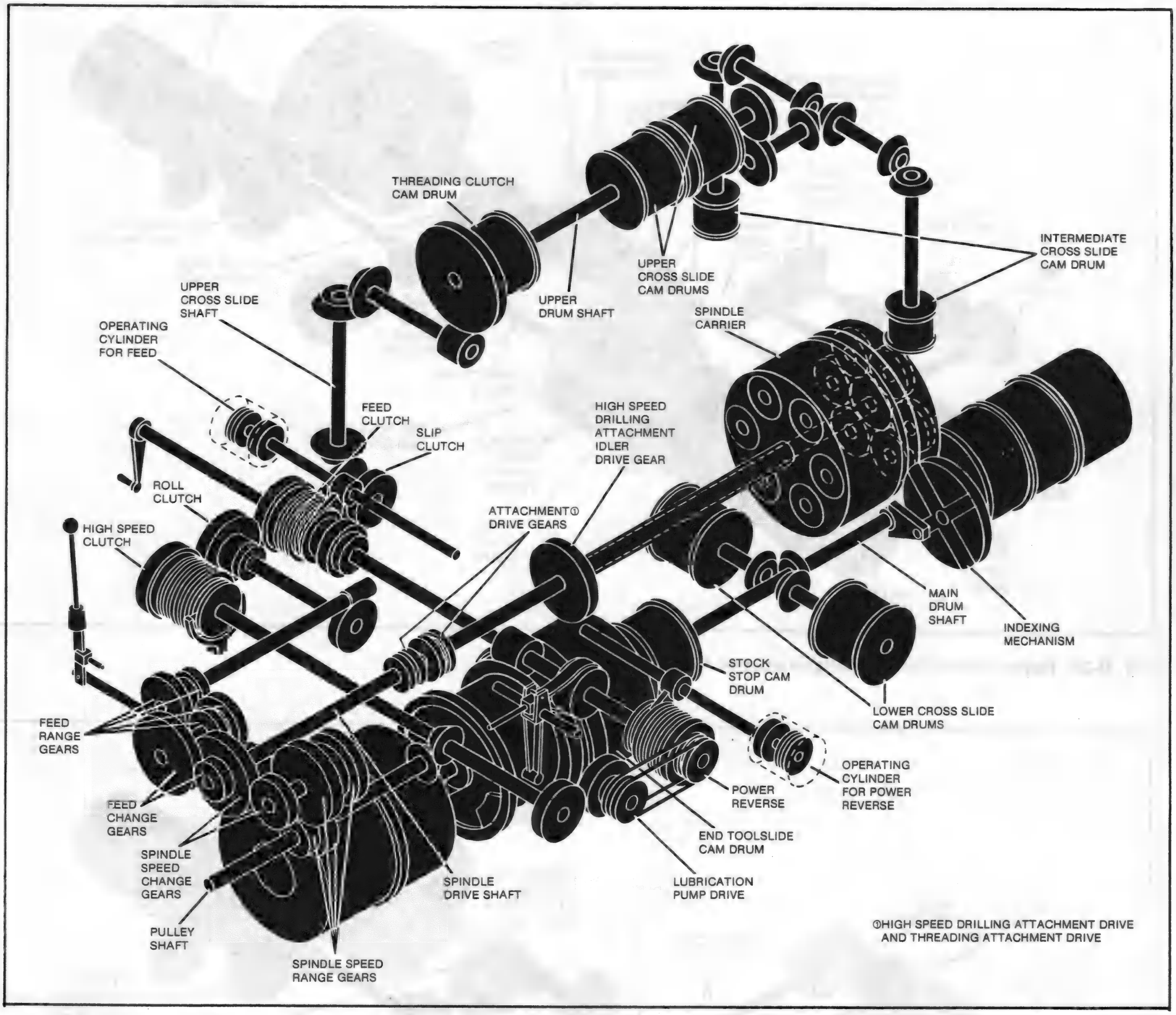

THREADING CLUTCH CAM DRUM
INTERMEDIATE CROSS SLIDE CAM DRUM
UPPER CROSS SLIDE CAM DRUMS
UPPER CROSS SLIDE SHAFT
UPPER DRUM SHAFT
SPINDLE CARRIER
OPERATING CYLINDER FOR FEED
FEED CLUTCH
SLIP CLUTCH
HIGH SPEED DRILLING ATTACHMENT IDLER DRIVE GEAR
ROLL CLUTCH
HIGH SPEED CLUTCH
ATTACHMENT① DRIVE GEARS
MAIN DRUM SHAFT
INDEXING MECHANISM
STOCK STOP CAM DRUM
LOWER CROSS SLIDE CAM DRUMS
FEED RANGE GEARS
OPERATING CYLINDER FOR POWER REVERSE
POWER REVERSE
FEED CHANGE GEARS
END TOOLSLIDE CAM DRUM
SPINDLE SPEED CHANGE GEARS
SPINDLE DRIVE SHAFT
LUBRICATION PUMP DRIVE
①HIGH SPEED DRILLING ATTACHMENT DRIVE AND THREADING ATTACHMENT DRIVE
PULLEY SHAFT
SPINDLE SPEED RANGE GEARS

Fig. B-23. Power transmission components of the 2⅝″ RB-6 machine shown schematically.

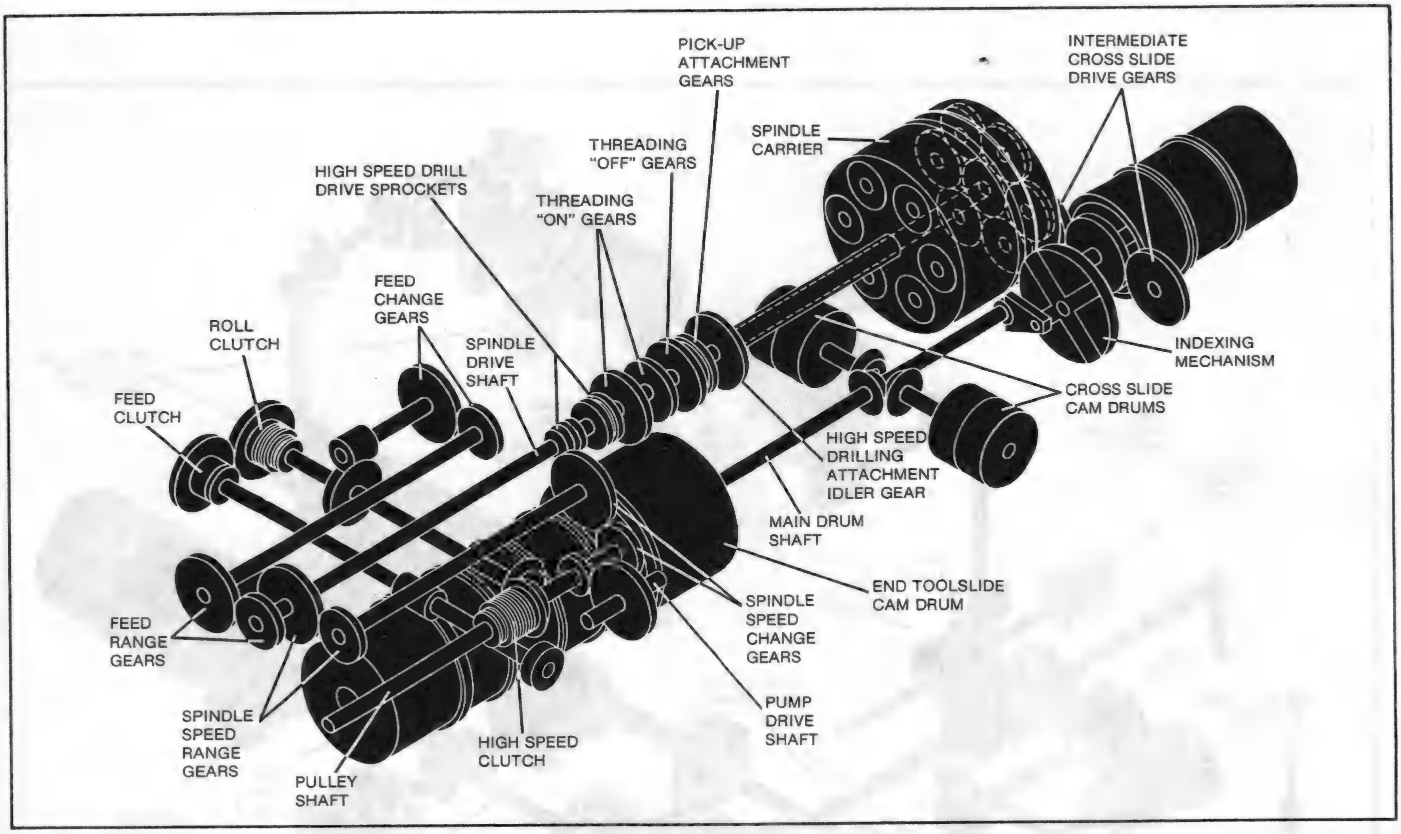

PICK-UP ATTACHMENT GEARS
INTERMEDIATE CROSS SLIDE DRIVE GEARS
SPINDLE CARRIER
THREADING "OFF" GEARS
HIGH SPEED DRILL DRIVE SPROCKETS
THREADING "ON" GEARS
FEED CHANGE GEARS
ROLL CLUTCH
SPINDLE DRIVE SHAFT
INDEXING MECHANISM
CROSS SLIDE CAM DRUMS
FEED CLUTCH
HIGH SPEED DRILLING ATTACHMENT IDLER GEAR
MAIN DRUM SHAFT
END TOOLSLIDE CAM DRUM
SPINDLE SPEED CHANGE GEARS
FEED RANGE GEARS
PUMP DRIVE SHAFT
SPINDLE SPEED RANGE GEARS
HIGH SPEED CLUTCH
PULLEY SHAFT

Fig. B-24. Power transmission components of the 7/16" RA-6 machine.

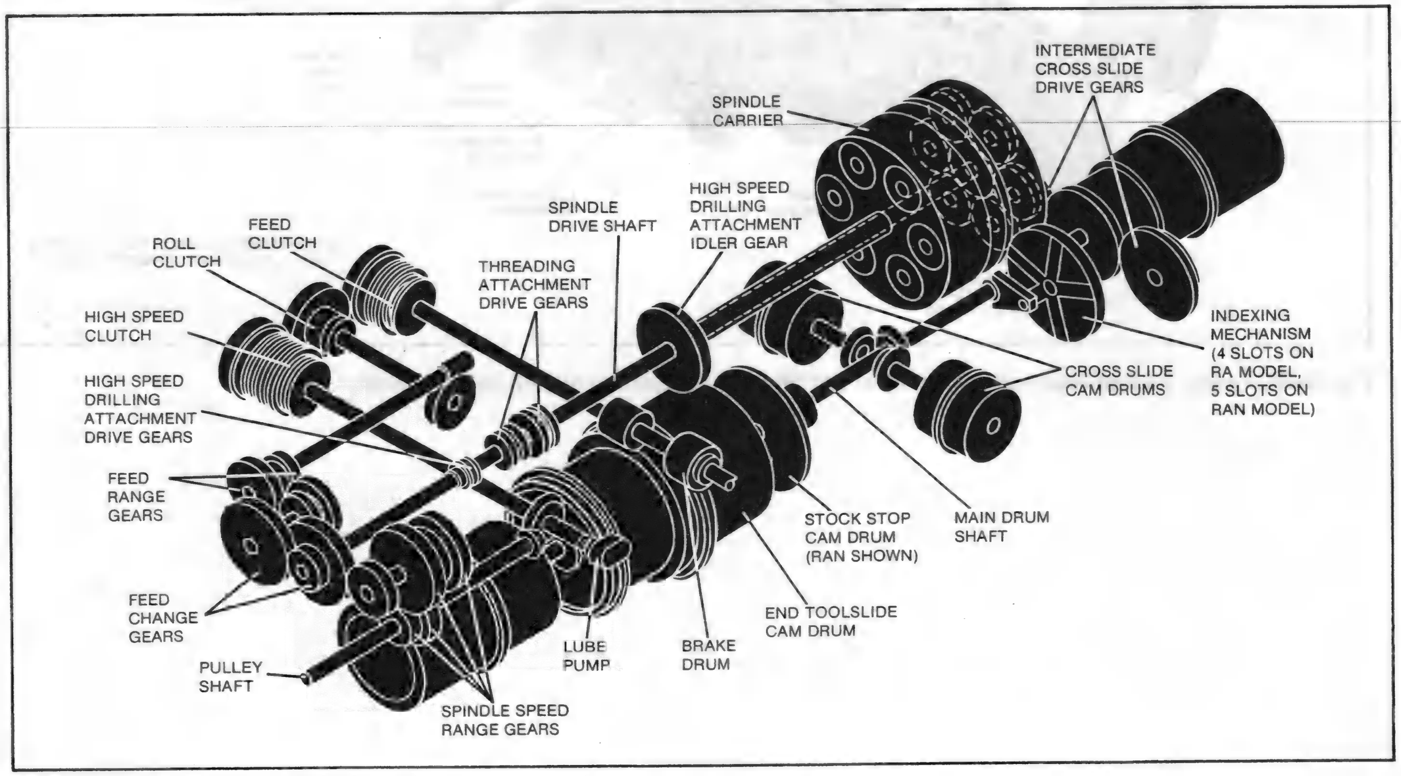

INTERMEDIATE CROSS SLIDE DRIVE GEARS
SPINDLE CARRIER
SPINDLE DRIVE SHAFT
HIGH SPEED DRILLING ATTACHMENT IDLER GEAR
FEED CLUTCH
ROLL CLUTCH
THREADING ATTACHMENT DRIVE GEARS
HIGH SPEED CLUTCH
INDEXING MECHANISM (4 SLOTS ON RA MODEL, 5 SLOTS ON RAN MODEL)
CROSS SLIDE CAM DRUMS
HIGH SPEED DRILLING ATTACHMENT DRIVE GEARS
FEED RANGE GEARS
STOCK STOP CAM DRUM (RAN SHOWN)
MAIN DRUM SHAFT
FEED CHANGE GEARS
END TOOLSLIDE CAM DRUM
LUBE PUMP
BRAKE DRUM
PULLEY SHAFT
SPINDLE SPEED RANGE GEARS

Fig. B-25. Power transmission components of the 9/16" and 1" RA-6, RAN-6 machine.

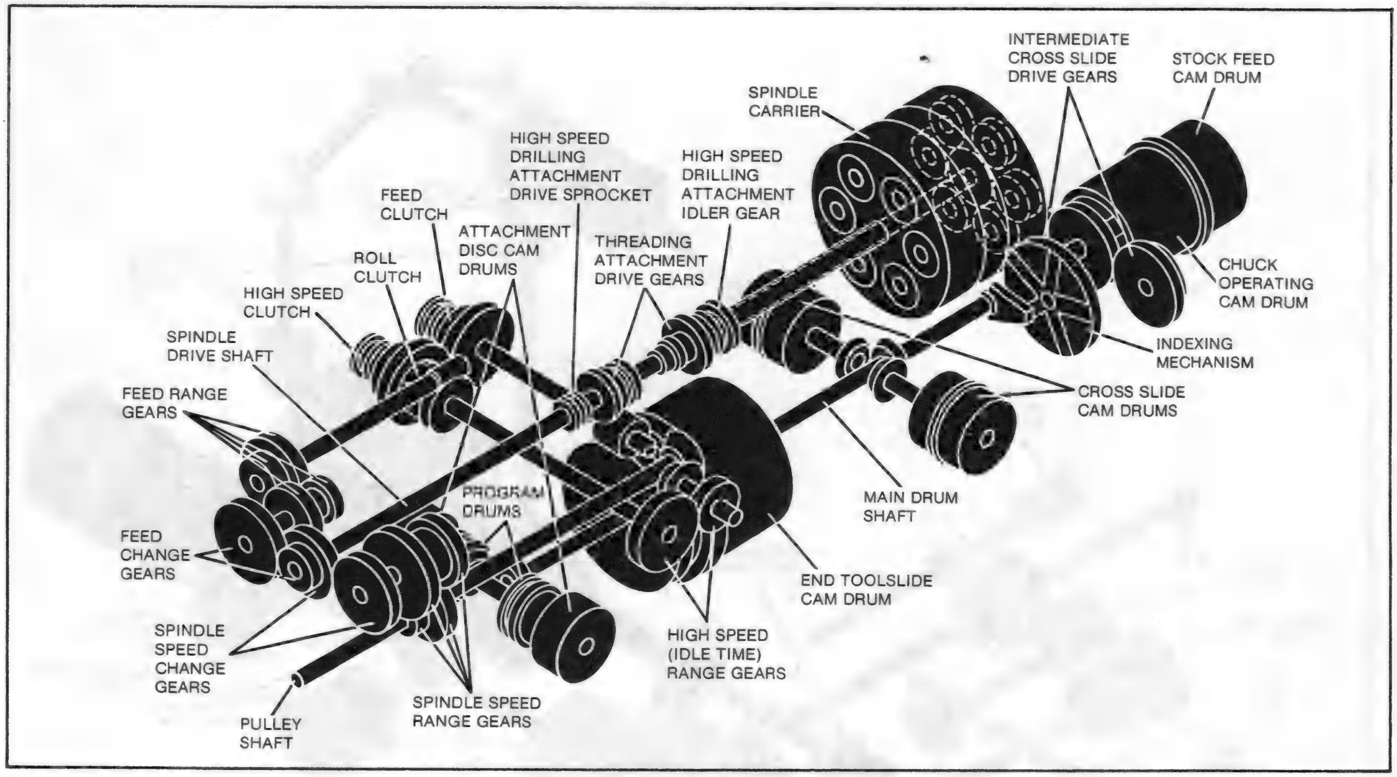

INTERMEDIATE CROSS SLIDE DRIVE GEARS
STOCK FEED CAM DRUM
SPINDLE CARRIER
HIGH SPEED DRILLING ATTACHMENT DRIVE SPROCKET
HIGH SPEED DRILLING ATTACHMENT IDLER GEAR
FEED CLUTCH
ATTACHMENT DISC CAM DRUMS
THREADING ATTACHMENT DRIVE GEARS
ROLL CLUTCH
HIGH SPEED CLUTCH
CHUCK OPERATING CAM DRUM
INDEXING MECHANISM
SPINDLE DRIVE SHAFT
CROSS SLIDE CAM DRUMS
FEED RANGE GEARS
MAIN DRUM SHAFT
PROGRAM DRUMS
FEED CHANGE GEARS
END TOOLSLIDE CAM DRUM
SPINDLE SPEED CHANGE GEARS
HIGH SPEED (IDLE TIME) RANGE GEARS
SPINDLE SPEED RANGE GEARS
PULLEY SHAFT

Fig. B-26. Power transmission components of the ⅝" RN-6 machine.

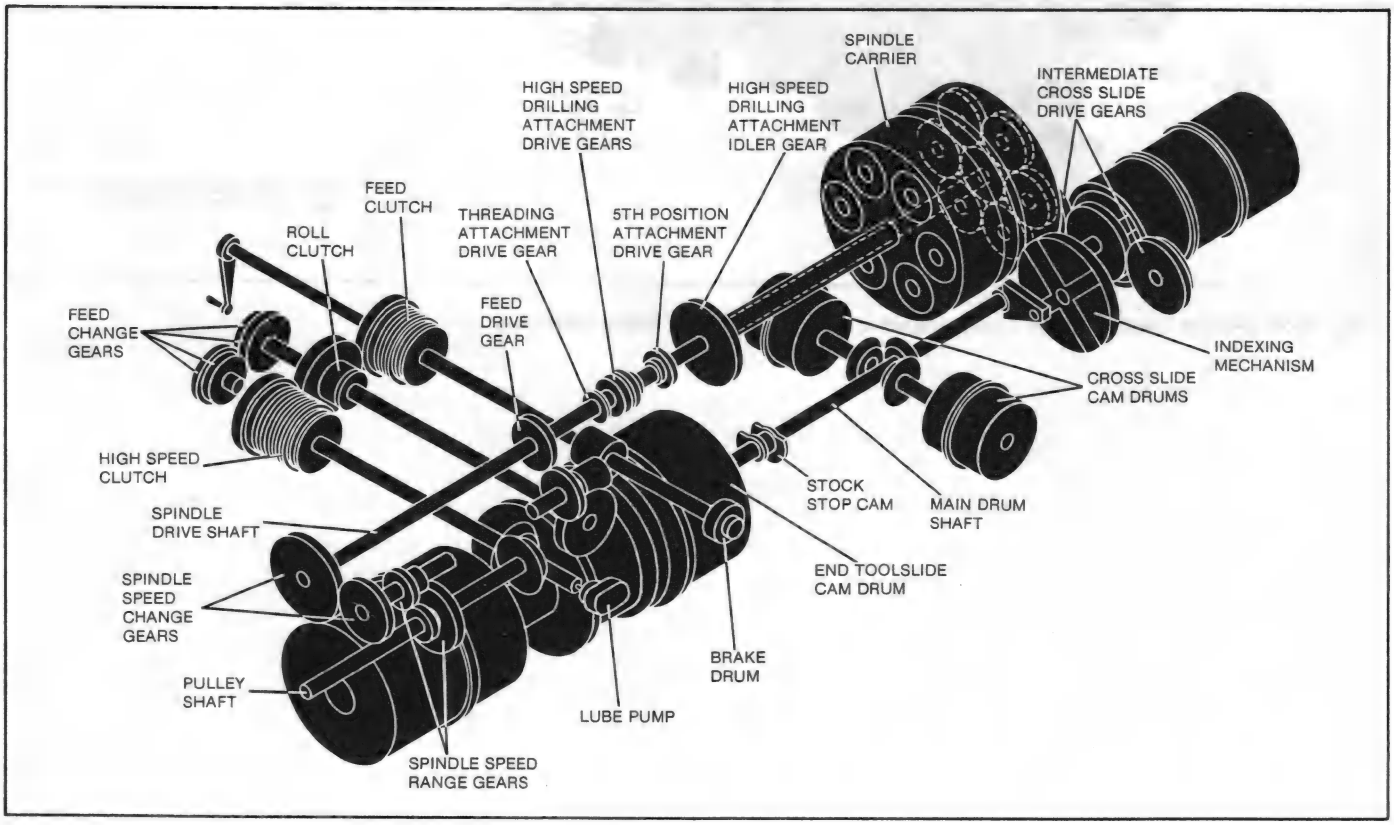
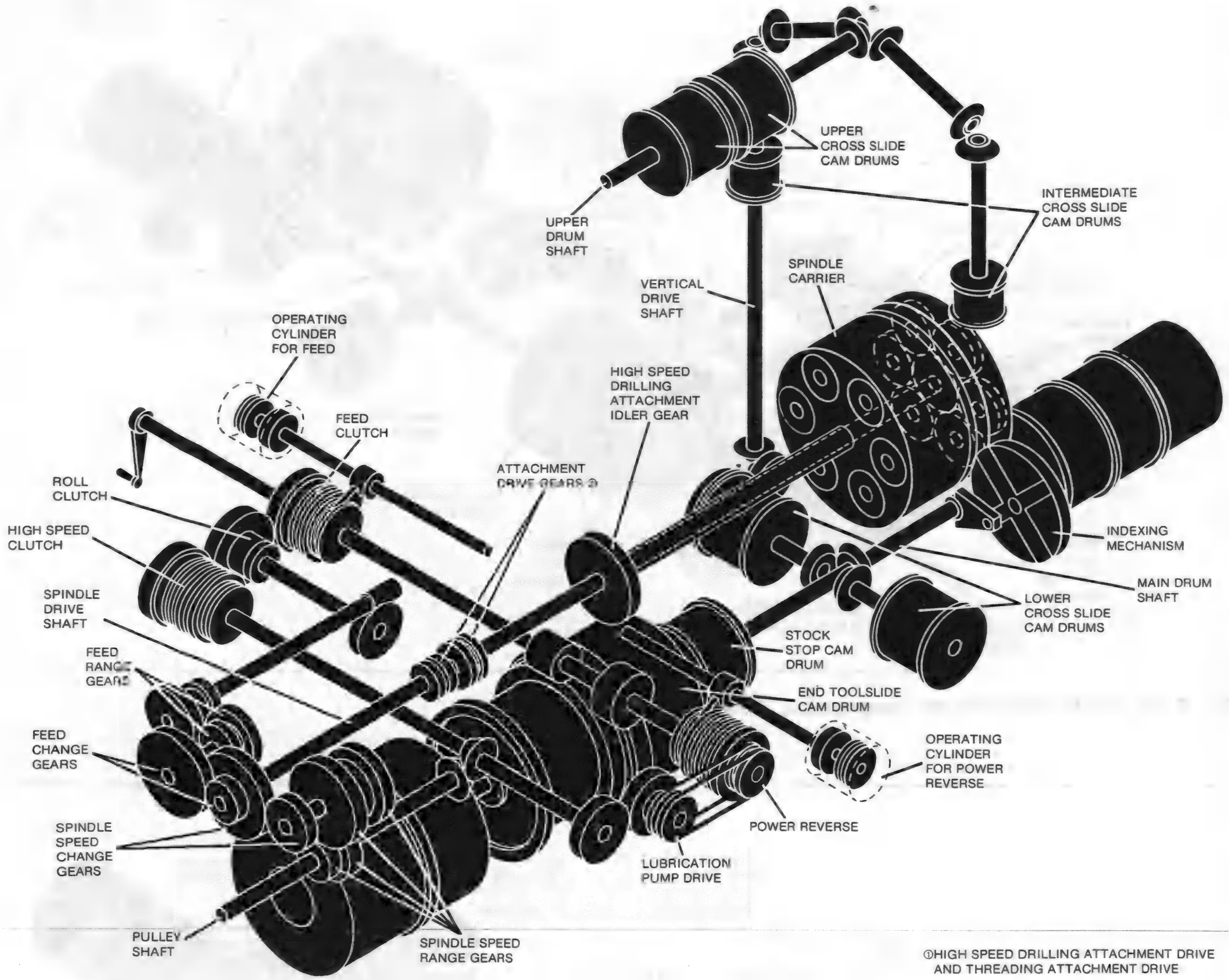

SPINDLE CARRIER
INTERMEDIATE CROSS SLIDE DRIVE GEARS
HIGH SPEED DRILLING ATTACHMENT DRIVE GEARS
HIGH SPEED DRILLING ATTACHMENT IDLER GEAR
FEED CLUTCH
ROLL CLUTCH
THREADING ATTACHMENT DRIVE GEAR
5TH POSITION ATTACHMENT DRIVE GEAR
FEED DRIVE GEAR
FEED CHANGE GEARS
INDEXING MECHANISM
CROSS SLIDE CAM DRUMS
HIGH SPEED CLUTCH
STOCK STOP CAM
MAIN DRUM SHAFT
SPINDLE DRIVE SHAFT
END TOOLSLIDE CAM DRUM
SPINDLE SPEED CHANGE GEARS
BRAKE DRUM
PULLEY SHAFT
LUBE PUMP
SPINDLE SPEED RANGE GEARS

Fig. B-27. Power transmission components of the 1¼" RA-6 machine.


UPPER CROSS SLIDE CAM DRUMS
INTERMEDIATE CROSS SLIDE CAM DRUMS
UPPER DRUM SHAFT
SPINDLE CARRIER
VERTICAL DRIVE SHAFT
OPERATING CYLINDER FOR FEED
HIGH SPEED DRILLING ATTACHMENT IDLER GEAR
FEED CLUTCH
ATTACHMENT DRIVE GEARS ①
ROLL CLUTCH
HIGH SPEED CLUTCH
INDEXING MECHANISM
MAIN DRUM SHAFT
SPINDLE DRIVE SHAFT
LOWER CROSS SLIDE CAM DRUMS
STOCK STOP CAM DRUM
FEED RANGE GEARS
END TOOLSLIDE CAM DRUM
FEED CHANGE GEARS
OPERATING CYLINDER FOR POWER REVERSE
SPINDLE SPEED CHANGE GEARS
POWER REVERSE
LUBRICATION PUMP DRIVE
PULLEY SHAFT
SPINDLE SPEED RANGE GEARS

①HIGH SPEED DRILLING ATTACHMENT DRIVE AND THREADING ATTACHMENT DRIVE

Fig. B-28. Power transmission components of the 1⅝" and 2" RB-6 machine.

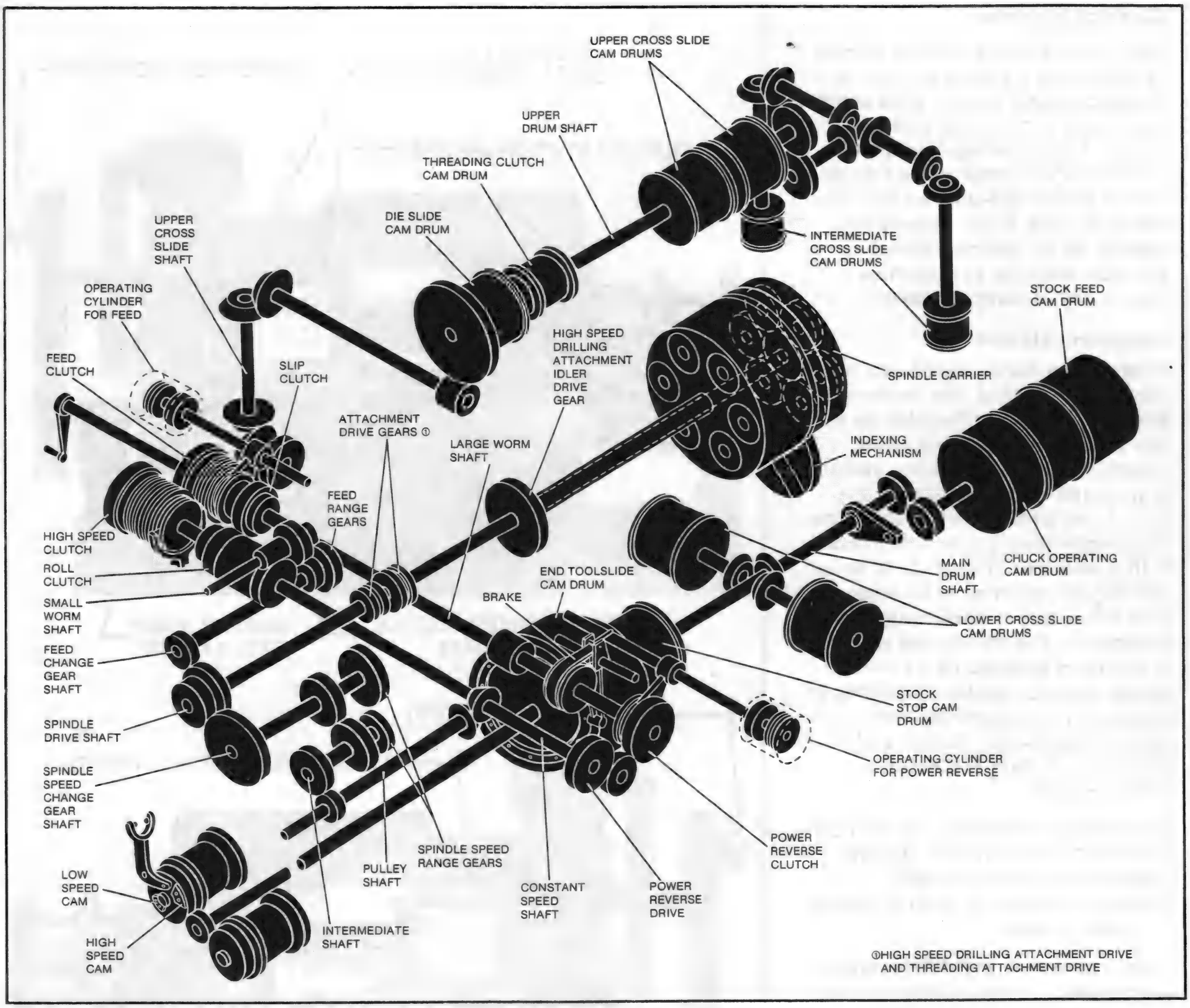

UPPER CROSS SLIDE CAM DRUMS
UPPER DRUM SHAFT
THREADING CLUTCH CAM DRUM
DIE SLIDE CAM DRUM
UPPER CROSS SLIDE SHAFT
INTERMEDIATE CROSS SLIDE CAM DRUMS
OPERATING CYLINDER FOR FEED
STOCK FEED CAM DRUM
HIGH SPEED DRILLING ATTACHMENT IDLER DRIVE GEAR
FEED CLUTCH
SLIP CLUTCH
SPINDLE CARRIER
ATTACHMENT DRIVE GEARS ①
LARGE WORM SHAFT
INDEXING MECHANISM
FEED RANGE GEARS
HIGH SPEED CLUTCH
ROLL CLUTCH
SMALL WORM SHAFT
END TOOLSLIDE CAM DRUM
BRAKE
MAIN DRUM SHAFT
CHUCK OPERATING CAM DRUM
LOWER CROSS SLIDE CAM DRUMS
FEED CHANGE GEAR SHAFT
SPINDLE DRIVE SHAFT
STOCK STOP CAM DRUM
OPERATING CYLINDER FOR POWER REVERSE
SPINDLE SPEED CHANGE GEAR SHAFT
POWER REVERSE CLUTCH
SPINDLE SPEED RANGE GEARS
PULLEY SHAFT
LOW SPEED CAM
CONSTANT SPEED SHAFT
POWER REVERSE DRIVE
HIGH SPEED CAM
INTERMEDIATE SHAFT
①HIGH SPEED DRILLING ATTACHMENT DRIVE AND THREADING ATTACHMENT DRIVE

Fig. B-29. Power transmission components of the 6″ RB-6 machine.

Control System

Many Acme-Gridley Multiple Spindle Bar Machines are equipped with a standard control system while some may have a customized control system. The following descriptions and illustrations refer to the standard control system supplied on 2⅝" RB-6 machines. (Fig. B-30) Refer to the detailed wiring diagram furnished with your machine to determine what, if any, differences exist.

Pushbutton Stations

All machines are equipped with two *pushbutton stations,* one on the front side (Fig. B-31) and the other on the rear side (Fig. B-32). As a safety feature, only one *pushbutton station* is in control of the machine at any time. As an added safety feature, the Main Motor Stop button is active on both *pushbutton stations* at all times, allowing the machine to be stopped from either side in case of an emergency. The station that is to be in control is selected by a built-in station selection system consisting of the Station-in-Control selector switch, Take Control button and Front/Rear Station-in-Control indicator light.

STATION IN CONTROL SELECTOR SWITCHES (one on each station). These switches select which *pushbutton station* is to be in control . . . Front or Rear.

TAKE CONTROL BUTTONS (one on each station). These buttons activate the selected station. Both Station-in-Control selector switches must be set at the same position before the Take Control button will activate the selected station.

FRONT/REAR STATION CONTROL INDICATOR LIGHTS (one on each station). The light that is ON indicates which station is in control of the machine.

MAIN MOTOR START BUTTON. With the main air pressure turned ON and the selector switch in RUN

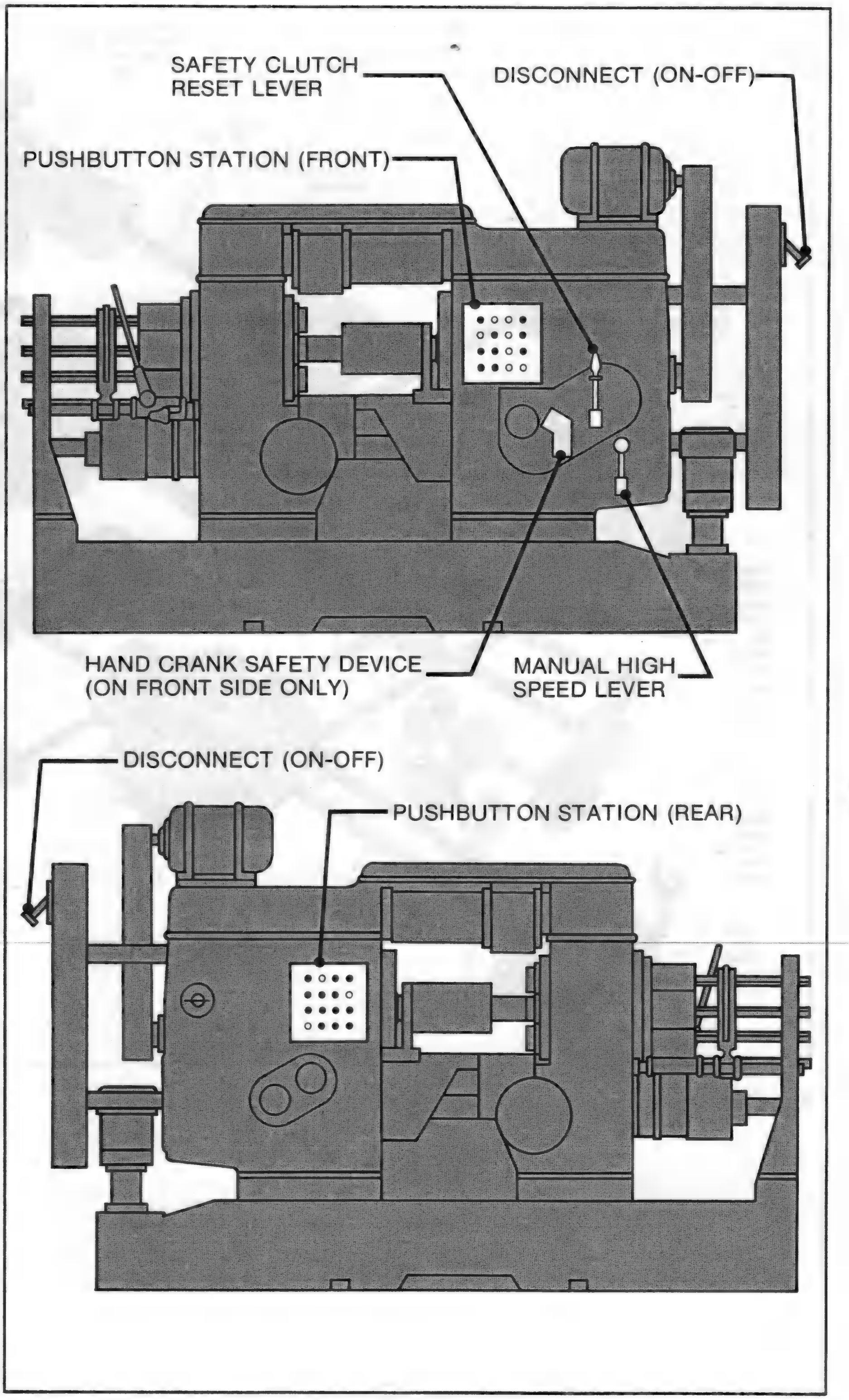

SAFETY CLUTCH RESET LEVER
DISCONNECT (ON-OFF)
PUSHBUTTON STATION (FRONT)
HAND CRANK SAFETY DEVICE (ON FRONT SIDE ONLY)
MANUAL HIGH SPEED LEVER
DISCONNECT (ON-OFF)
PUSHBUTTON STATION (REAR)

Fig. B-30. Location of standard machine controls on 2⅝" RB-6 machines.

position, the Main Motor Start button will start the main drive motor. This control is also interlocked with the lubricating oil pressure, requiring that the button be kept depressed (approximately ten seconds) until oil pressure builds up enough to close the oil pressure switch. The main motor will then run continuously.

MAIN MOTOR JOG-RUN SWITCH. This switch selects the mode of operation . . . RUN or JOG. When the selector is in the RUN position, the motor will run continuously after the Main Motor Start button is depressed. When the selector is in the JOG position, the motor will run only as long as the Start button is depressed. The motor will coast to a stop as soon as the Start button is released. It is only necessary to turn one selector switch on either side of the machine to secure JOG operation. However, both selector switches must be in the RUN position for normal operation.

MAIN MOTOR STOP BUTTON. This is a red mushroom type pushbutton. Since there are two pushbutton stations, pressing either Stop button will disengage the feed clutch and the main motor will coast to a stop.

FEED ON BUTTON. When the Feed On button is pressed, the feed clutch will be engaged.

FEED OFF BUTTON. Pressing this button will disengage the feed clutch. If the main motor is running, it will continue to run.

FEED REVERSE BUTTON. Pressing this button will engage the power reverse clutch, reversing the feed. The feed must be OFF and the Main Motor Jog-Run switch must be set on JOG for this action to take place. This control is normally used for setup purposes. To prevent indexing the spindle carrier in reverse under power, the feed reverse action is limited to the machining and approach portion of the end toolslide cam.

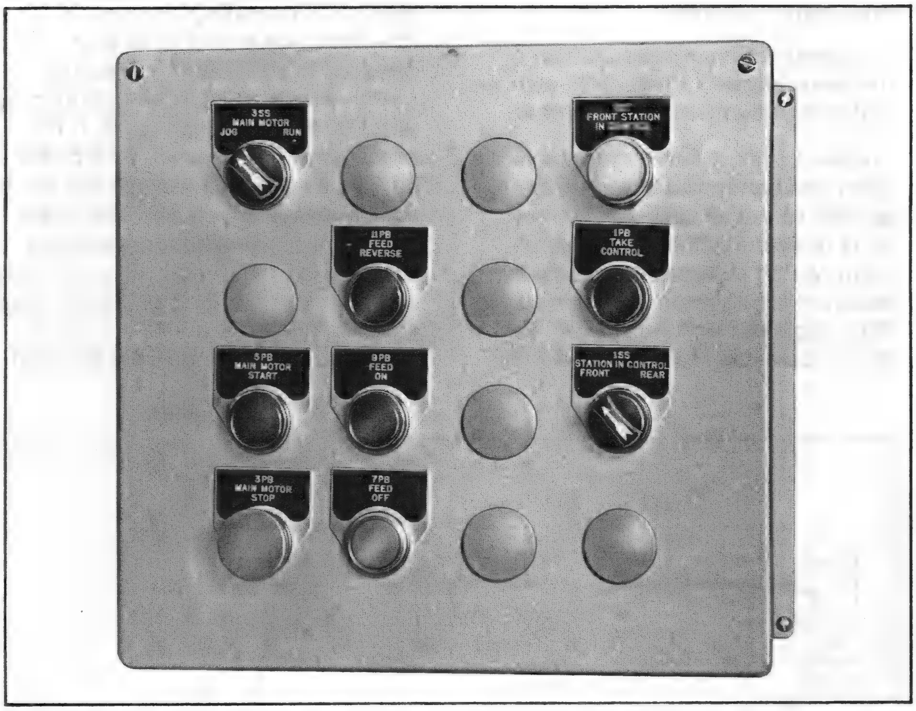

3SS
MAIN MOTOR
JOG RUN
FRONT STATION
IN
11PB
FEED
REVERSE
1PB
TAKE
CONTROL
5PB
MAIN MOTOR
START
9PB
FEED
ON
1SS
STATION IN CONTROL
FRONT REAR
3PB
MAIN MOTOR
STOP
7PB
FEED
OFF

Fig. B-31. Front side pushbutton station.

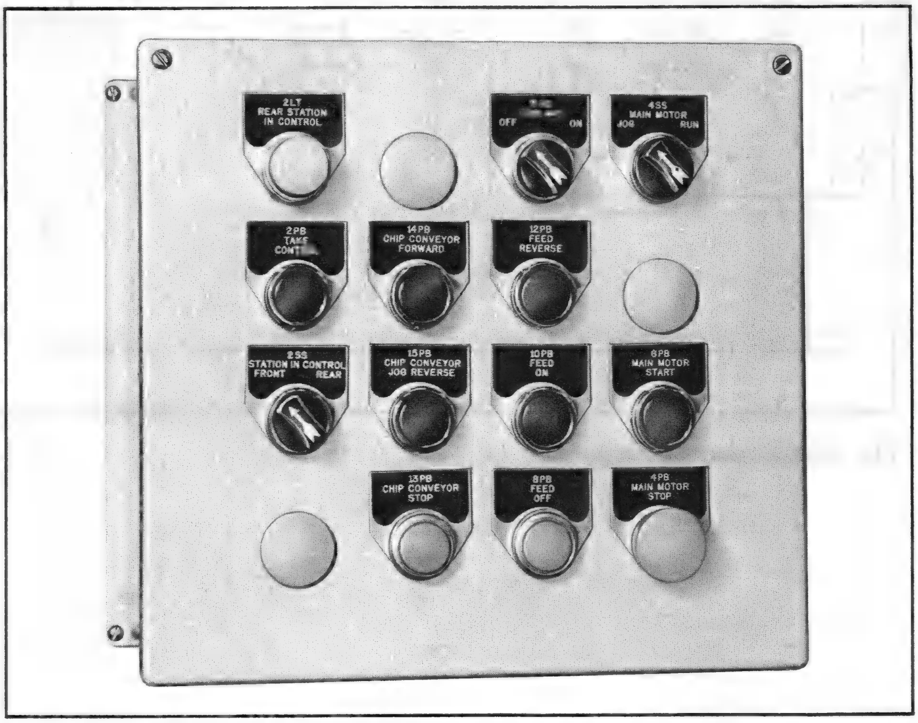

2LT
REAR STATION
IN CONTROL
OFF ON
4SS
MAIN MOTOR
JOG RUN
2PB
TAKE
CONT
14PB
CHIP CONVEYOR
FORWARD
12PB
FEED
REVERSE
2SS
STATION IN CONTROL
FRONT REAR
15PB
CHIP CONVEYOR
JOG REVERSE
10PB
FEED
ON
6PB
MAIN MOTOR
START
13PB
CHIP CONVEYOR
STOP
8PB
FEED
OFF
4PB
MAIN MOTOR
STOP

Fig. B-32. Rear side pushbutton station.

Pneumatic Controls

The pneumatic controls consist of the items shown in Fig. B-33 with the addition of two pressure switches.

The Air Lockout Valve must be in the open position in order for air to be applied to the air devices. Incoming air is directed to the condensate drain, which automatically expells moisture from the air line, and to the filter, regulator and lubricator. The design pressure is 60 PSI and the maximum operating pressure is 80 PSI. Pressure at 80 PSI is then directed to the Main Air pressure switch which is set to be operated by air at 60 PSI rising pressure. If the pressure at the machine falls below 60 PSI, the pressure switch will fall to the unoperated position. This open condition of the pressure switch is wired in the main motor circuit of the machine and prevents the motor from starting. Solenoid valves control the air cylinders which operate the feed and reverse clutches. When the valves are energized, the clutches are engaged.

A pressure switch in the lubrication system is also wired into the main motor start circuit. It prevents the main motor start circuit from locking in until lubricating oil pressure has operated the pressure switch. The Main Motor Start button must be held in until the pressure switch is operated.

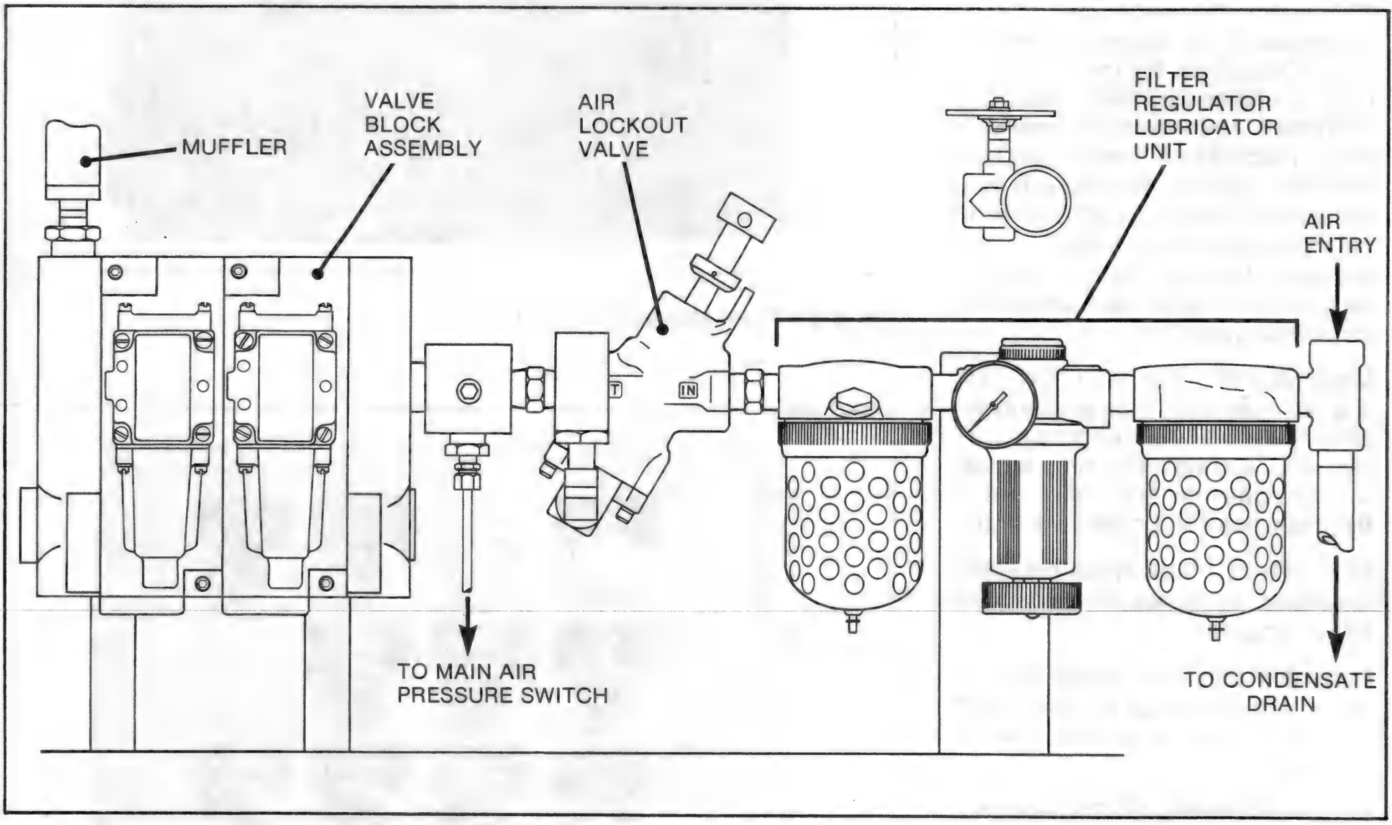

MUFFLER
VALVE BLOCK ASSEMBLY
AIR LOCKOUT VALVE
T
IN
FILTER REGULATOR LUBRICATOR UNIT
AIR ENTRY
TO MAIN AIR PRESSURE SWITCH
TO CONDENSATE DRAIN

Fig. B-33. Pneumatic controls.

SECTION C: INSTALLATION
Table of Contents

General 2
Foundation 2
Leveling 2
Lubricating Oil 4
Pneumatic Hook-Up 5
Connect Electric Power 5
Stock Reel Installation 6
Level and Align Stock Reel 7

INSTALLATION

General

Your Acme-Gridley Multiple Spindle Bar Machine has been given a final turning test prior to shipment. After the "run-in period" all lubricants and cutting fluids are removed from their respective reservoirs in the machine. The machine is thoroughly cleaned and finish painted with a protective coating applied to all finished surfaces. Loose extra parts are crated, critical components are carefully blocked and the entire machine is mounted on a skid for shipment.

On receiving the machine, check the contents of all crates and extra material against the enclosed shipping list. Notify National Acme immediately if any discrepancies exist. Check the machine and its components for any damage that may have occurred during shipment. Notify both your carrier and National Acme immediately upon discovery of any damages.

NOTE: Delay removal of protective coating from finished surfaces until the machine is properly installed and ready for operation.

Foundation

An Acme-Gridley Multiple Spindle Bar Machine is a precision machine tool. To maintain this precision over a long trouble-free service life, the machine should be set on a sturdy floor with the pan resting firmly at all points. An average shop floor is adequate for machines up to 1⅝" in size. All machines 1⅝" size and larger require a foundation with a minimum of 8 inches of reinforced concrete.

Leveling

Once in location on its foundation, the machine must be level in both directions. Checking the level of the machine is best accomplished with a graduated bubble level.

NOTE: A bubble level which indicates level within 0.005" per foot with increments of 0.1" is recommended.

On small machines, place the level on the end toolslide to check axial level and on one of the lower cross slides to check transverse level. On larger machines, use leveling bars placed on the provided leveling pads. (Fig. C-1)

Adjustments to level the machine are made with leveling jacks provided with each machine. (Fig. C-2) After the leveling operation is completed, use steel shims or other suitable supports under the entire edge of the pan, making sure the machine rests firmly at all points. The jacks should not be used to support the machine during operation.

IMPORTANT: Check the level of the machine periodically and adjust as necessary. A level machine is necessary to maintain maximum machine performance and minimize maintenance problems.

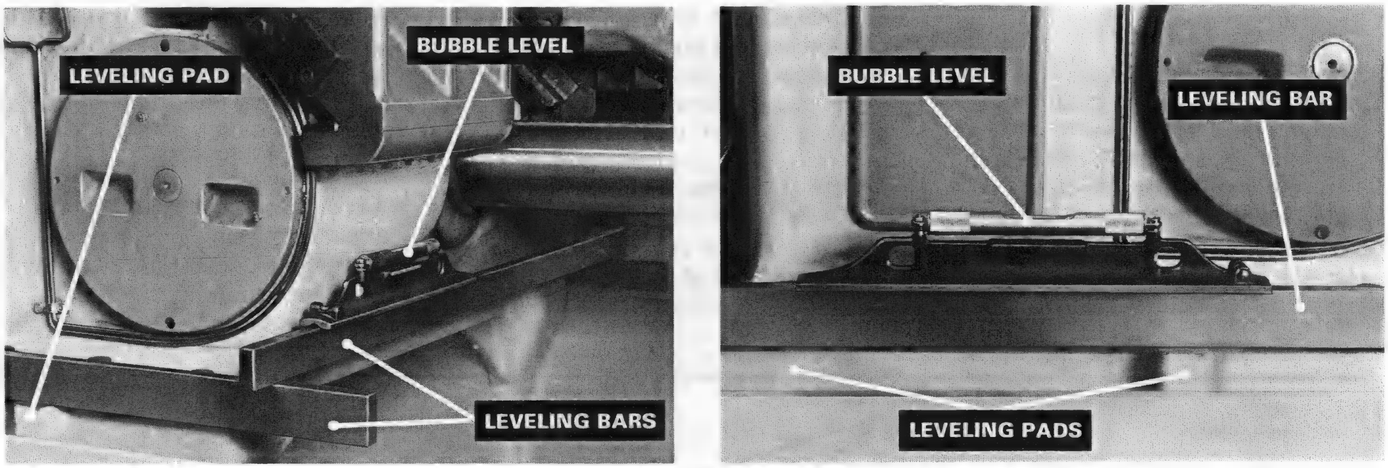

LEVELING PAD
BUBBLE LEVEL
LEVELING BARS
BUBBLE LEVEL
LEVELING BAR
LEVELING PADS

Fig. C-1. Use leveling bars to check level of larger machines.

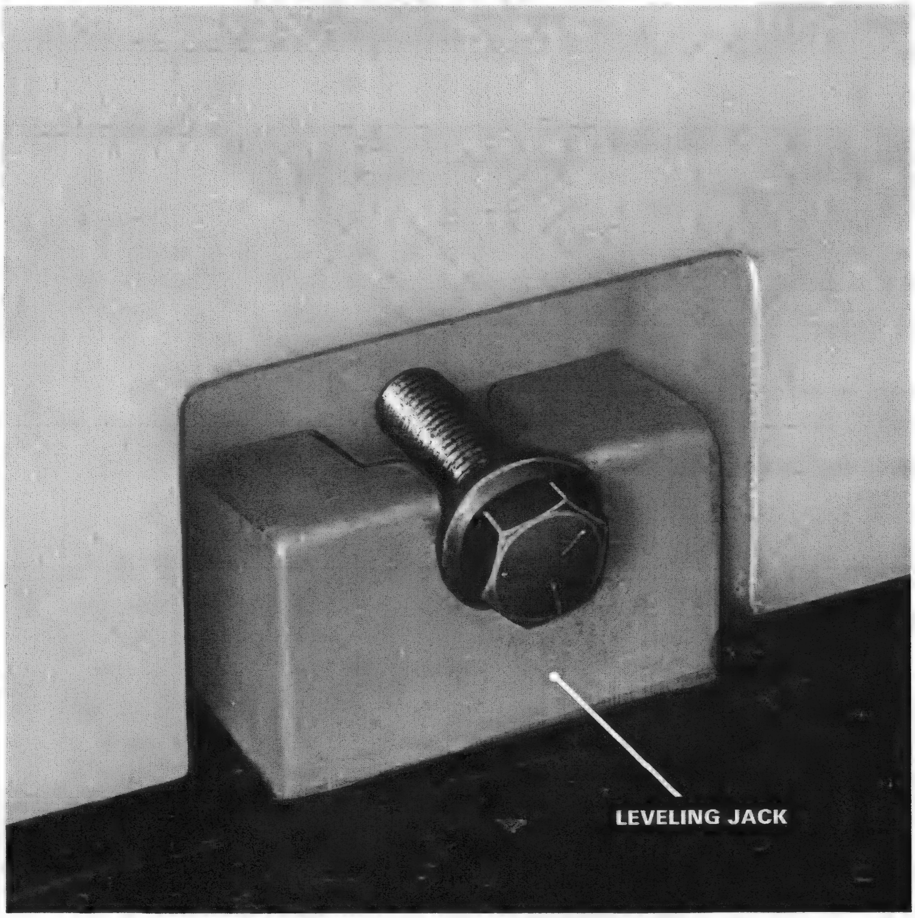

LEVELING JACK

Fig. C-2. Use leveling jacks to adjust the machine level.

Lubricating Oil

Before the machine is run, it is very important that the lubricating oil reservoir be filled. Refer to Maintenance, section F, pages 2 and 3, of this manual for lubricating oil and grease specifications. Running the machine without lubrication will result in severe damage. Oil cups not served by the automatic system should be filled. Chip conveyors or outside coolant pumps must be lubricated individually. Attachments in the tooling zone should be checked to see if they require individual lubrication. All grease fittings should be properly greased. Check to be sure that the oil lines to the main spindle bearings have not been jarred out of position during transit. On machines using double spindle bearing construction, the lines should be directed to the flinger spacer. (Fig. C-3) Where single spindle bearing construction is used, the lines should be directed to the bearing cavity. (Fig. C-4)

When supplementary automatic lubricating systems are furnished, refer to the manufacturer's service manual for instructions before running the machine.

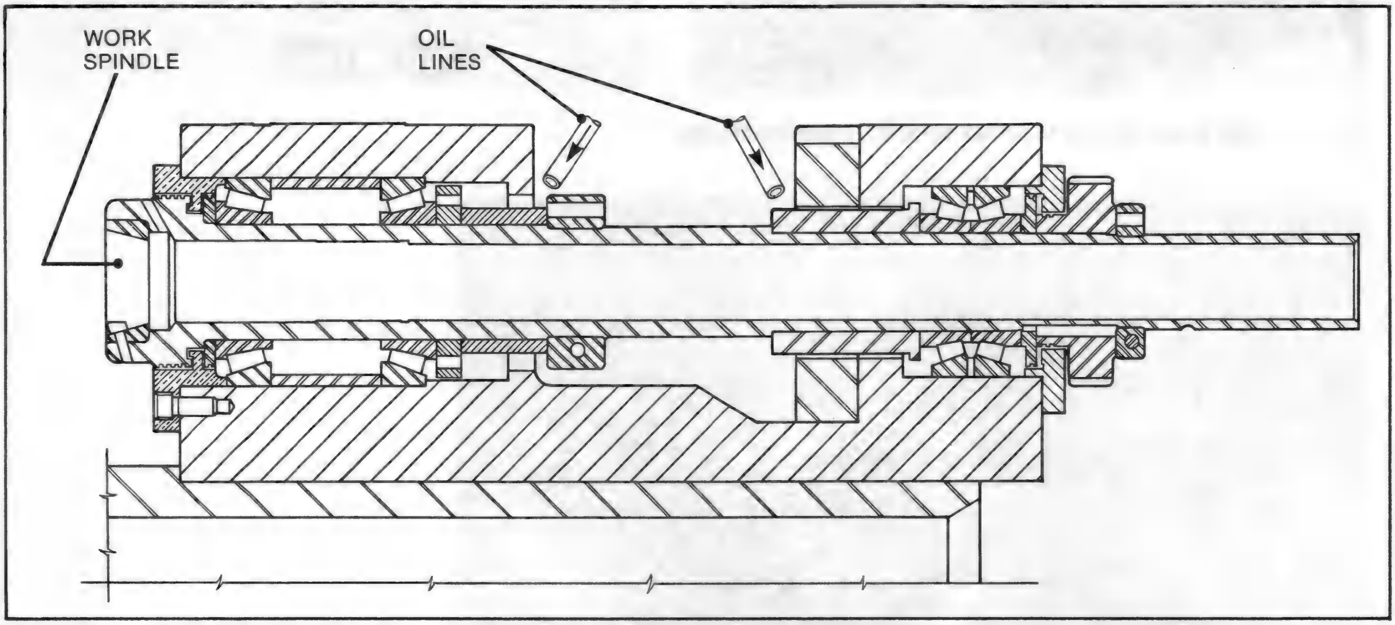


Fig. C-3. Oil lines directed to flinger spacer on double spindle bearing construction.

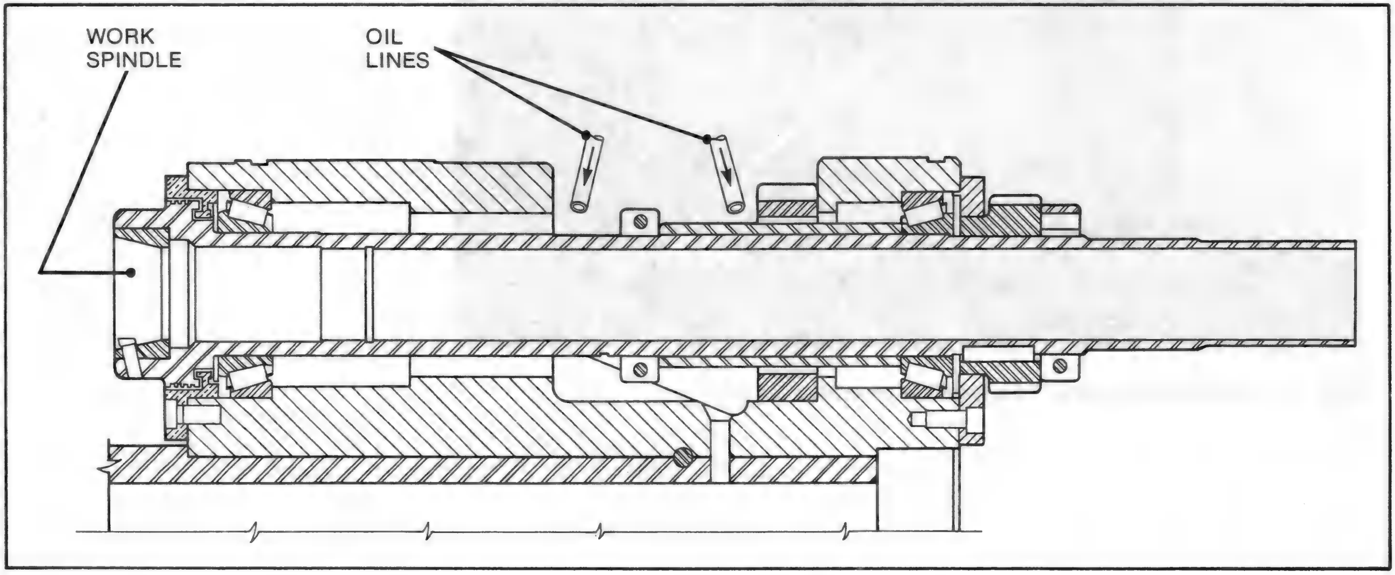


Fig. C-4. Oil lines directed to bearing cavity on single spindle bearing construction.

Lubricating Oil

Before the machine is run, it is very important that the lubricating oil reservoir be filled. Refer to Maintenance, section F, pages 2 and 3, of this manual for lubricating oil and grease specifications. Running the machine without lubrication will result in severe damage. Oil cups not served by the automatic system should be filled. Chip conveyors or outside coolant pumps must be lubricated individually. Attachments in the tooling zone should be checked to see if they require individual lubrication. All grease fittings should be properly greased. Check to be sure that the oil lines to the main spindle bearings have not been jarred out of position during transit. On machines using double spindle bearing construction, the lines should be directed to the flinger spacer. (Fig. C-3) Where single spindle bearing construction is used, the lines should be directed to the bearing cavity. (Fig. C-4)

When supplementary automatic lubricating systems are furnished, refer to the manufacturer's service manual for instructions before running the machine.

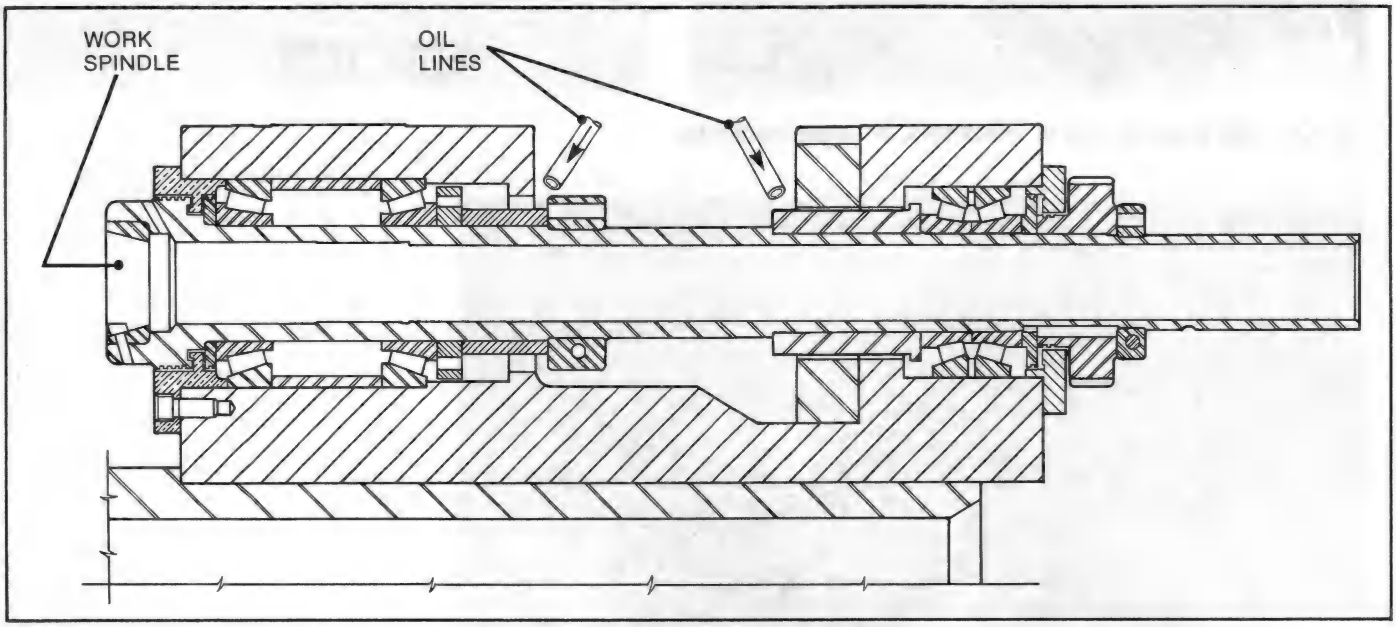


Fig. C-3. Oil lines directed to flinger spacer on double spindle bearing construction.

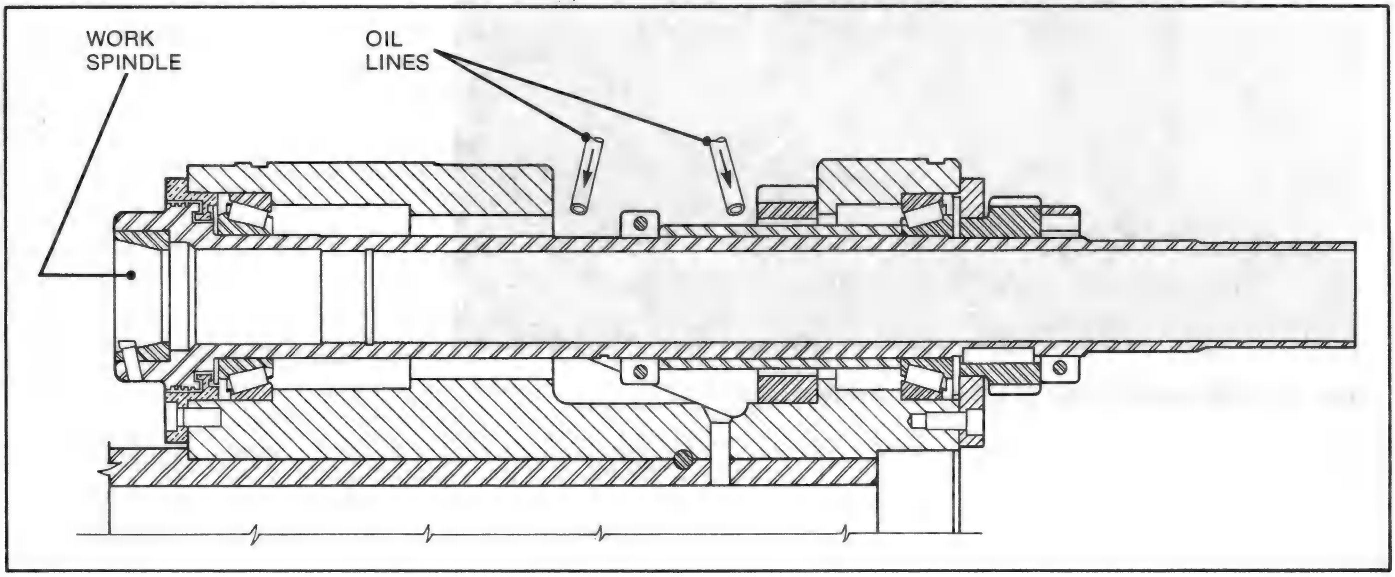


Fig. C-4. Oil lines directed to bearing cavity on single spindle bearing construction.

Pneumatic Hook-Up

If the machine is equipped with pneumatically operated devices, an adequate supply of clean, dry, compressed air must be provided. (For air supply volume, refer to Appendix, section H, page 16.) Recommended maximum operating air pressure is 80 PSI. The air supplied is connected to the air supply inlet as shown in Figure C-5.

Fill the pneumatic line lubricator with pneumatic oil and adjust so it will release one drop of oil each time the pneumatic cylinders are operated. (For pneumatic lubricating oil specifications, refer to Maintenance, section F, page 3.) If the pneumatic cylinders are to operate frequently, reduce this rate of oil flow. If operation is to be intermittent, increase the rate of oil flow.

CAUTION: Excessive lubrication may cause sluggish cylinder action.

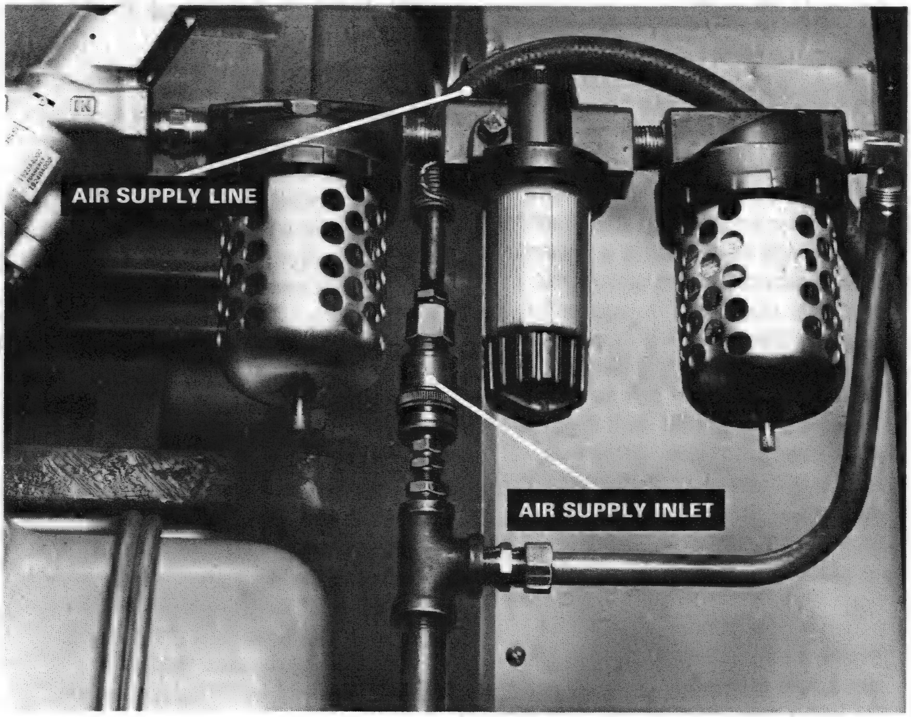


Fig. C-5. Connect air supply to air supply inlet.

Connect Electric Power

An individual wiring diagram is made and supplied with every machine. Mounted externally on the door of the electrical control equipment enclosure is an electrical data plate. The machine should be connected to the electrical power supply and grounded in accordance with prevailing electrical codes and good practice. Refer to the electrical diagram or data plate for correct voltage, phase and cycles. The machine is now ready to operate. Read the safety instructions in section A before proceeding. The machine should be operated by power, and the direction of rotation of the spindles should be checked for counterclockwise rotation when viewed from the tooling zone.

NOTE: A listing of nationally recognized electrical codes appears in Appendix, section H, page 16. Other local codes may prevail.

Stock Reel Installation

After the machine has been leveled, firmly set on its foundation and is in running order, the stock reel assembly can be installed. Remove the pusher tubes from the machine so they will not be bent accidentally. Before mounting the stock reel to the machine, position the pusher tube aligning disc as close as possible to the stock support ring gear and clamp it in position temporarily. Remove the top half of the stock feed shaft support. Apply generous amounts of grease to the working surfaces of the stock feed shaft support and stock support ring gear and also to the gear teeth on the stock reel drive gear and the stock support ring gear. For small machines fill the reservoir in the stock reel stand with lubricating oil. On large machines check that the felt inserts in the stock reel support stand are in place and well saturated with lubricating oil.

CAUTION: To prevent damaging the stock reel tubes, use only the center tube for lifting or lowering the stock reel assembly.

7/16" RA-6; 9/16" and 1" RA-6, RAN-6; 5/8" RN-6; 1¼" RA-6 Machines

Lower the stock reel into the stock feed shaft support engaging the gears so that the stock reel tube holes in the stock support ring gear are in line with the work spindles. A simple way to check the alignment is to install several pusher tubes and check for equal clearance around the spools when they pass thru the holes in the stock support ring gear.

NOTE: For 1¼" RA-6 machines only, if stock reel tubes will not line up with work spindles, lift and turn the stock reel to the next position in either direction. For 7/16" RA-6 machines, check that the felt inserts in the stock reel support stand are in place and well saturated with lubricating oil.

3/4" RA-8 and All Machines 1¼" RB-8 and Larger

On larger size machines, the stock reel drive gear, stock feed shaft support and the stock support ring gear are stamped with timing marks "O" to simplify installation. Index the machine until the "O" mark on the stock reel drive gear lines up with the "O" mark in the bore of the stock feed shaft support (Fig. C-6) and the number one spindle is in the first position. (Position numbers are stamped at the bottom of the keyway toward the rear end of toolslide.)

Some machines may have to be indexed a number of times before the "O" marks line up and the number one spindle is in the first position. Lower the reel into place, aligning "O" mark on outside of stock feed shaft support with "O" mark on stock support ring gear. (Fig. C-7) A simple way to check the alignment is to install several pusher tubes and check for equal clearance around the spools when they pass thru the holes in the stock support ring gear.

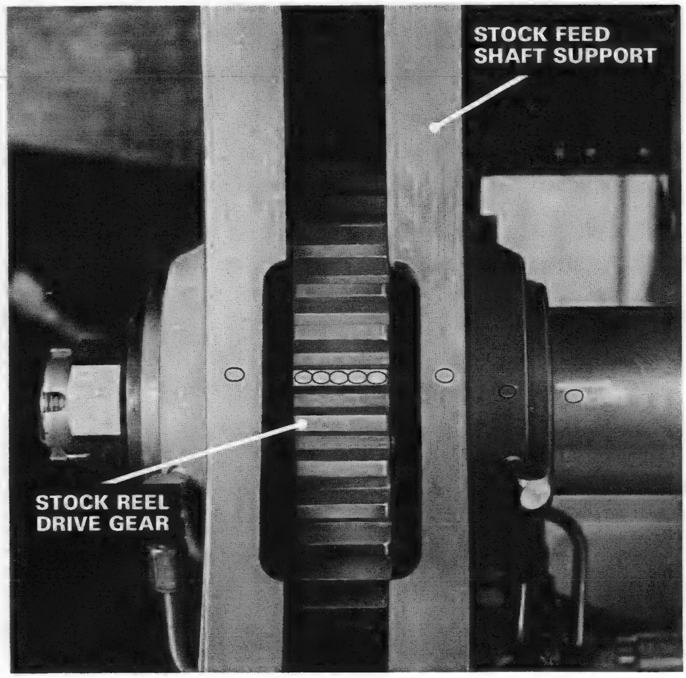


Fig. C-6. Position the "O" mark on the stock reel drive gear to align with "O" mark in the bore of the stock feed shaft support.

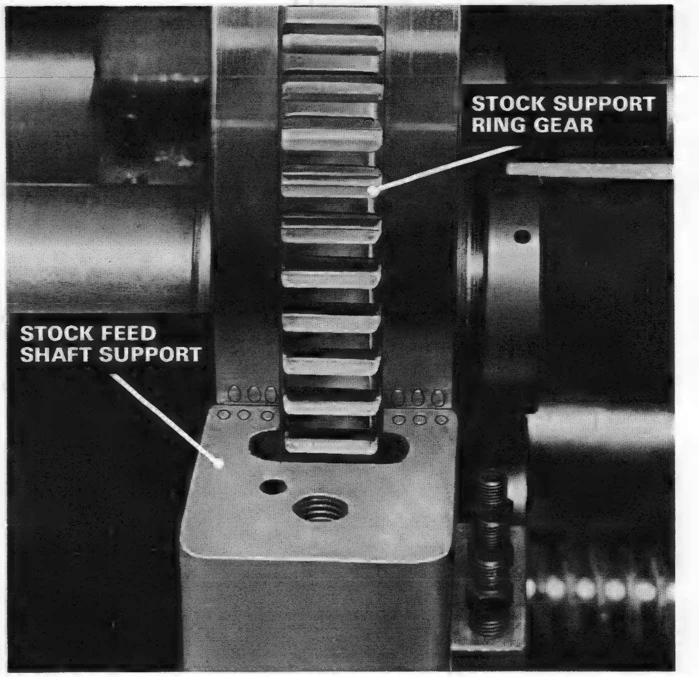


Fig. C-7. Position the "O" mark on the outside of stock feed shaft support in line with "O" mark on stock support ring gear.

Level and Align Stock Reel

Place a level on the center support tube near the middle of the reel and adjust the support stand to suit. Alignment in the horizontal plane is accomplished by equalizing the clearances between the face of the stock support ring gear and the slot in the stock feed shaft support. (Fig. C-8)

Both spaces can be made the same by moving the far end of stock reel to the right or left as necessary. After aligning the stock reel and stand, fasten the stand securely to the floor. Be careful not to disturb the alignment. Recheck level and horizontal alignment. Install the top half of the stock feed shaft support and fasten securely in place.

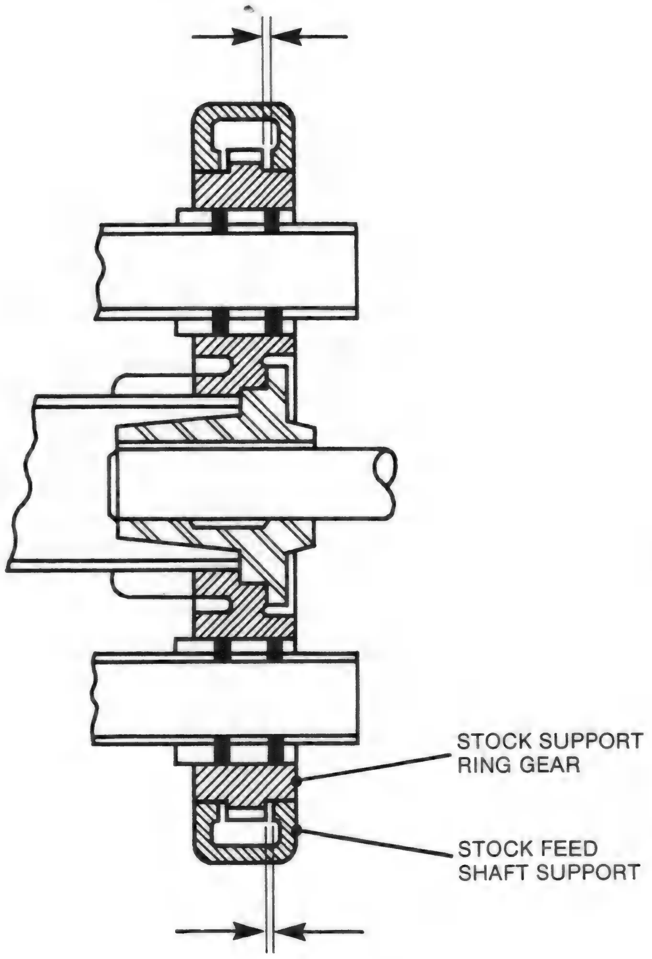


Fig. C-8. Equalize clearances between face of stock support ring gear and slot in stock feed shaft support.

SECTION D: SETUP
Table of Contents

Setup Preparation 2
Tooling Setup Chart 3
Toolslide Dimensions 4
Setup Procedures.......... 5
1. Change Stock Feed Cams 5
2. Remove Collets, Pushers and Spool Bushings 8
3. Install Correct Collets, Pushers and Spool Bushings 14
4. Load Bar Stock 18
5. Change Remaining Collets, Pushers and Spool Bushings 20
6. Cancel Feeding of Bar Stock 20
7. Change Spindle Speed and Feed Gears 21
8. Change End Toolslide Cam.......... 24
9. Set Toolslide Master Stop.......... 25
10. Change Cross Slide Cams 26
11. Check Machine Cycle Time.......... 31
12. Mount Cutoff Tool 31
13. Determine Length of Stock.......... 33
14. Set Stock Stop 34
15. Feed Out Test Bar 35
16. Move Test Bar to Cutoff Position 35
17. Mark Part with Cutoff Tool 36
18. Set Sixth Position Tools.......... 36
19. Set First Position Tools.......... 40
20. Set Second Position Tools 43
21. Set Third Position Tools 44
22. Set Fourth Position Tools.......... 47
23. Set Fifth Position Tools.......... 48
24. Install Coolant Lines.......... 50
25. Make Tool Adjustments 50
26. Install Work Chute.......... 51
27. Make Final Adjustments.......... 51
Typical Example Parts (4 spindle).......... 52
Typical Example Parts (6 spindle).......... 54
Typical Example Parts (8 spindle).......... 56
Spindle Position vs Operation (4 spindle) 58
Spindle Position vs Operation (6 spindle) 60
Spindle Position vs Operation (8 spindle) 62

SETUP

SETUP PREPARATION

The downtime of the machine and the labor required to set up a machine can be greatly reduced by proper preparation. Many operators begin preparing for a new setup while the machine is running the present parts. This is done away from the machine proper and includes "checking in" the items required for the next setup using the Tooling Setup Chart as a checklist. In some cases, tools and toolholders may be available which are not presently being used. These can be checked for proper fits and can be cleaned; also any nicks or burrs can be removed.

The cutting tools can be set in the holders on the bench to proper cutting height and location. Refer to toolslide dimension section of *Acme-Gridley Multiple Spindle Bar Machine Manual Supplement* for tool location data. (See Fig. D-3) Condition of collets, pushers, spool bushings, cams and other tooling attachments specified on the Tooling Setup Chart can be checked and repaired or replaced as necessary.

When the machine is ready for setup, begin by removing all cutting tools and toolholders from the previous setup. Remove the cutting tools from the toolholders; clean and oil them preparatory to storage. Clean and oil the toolholders, sending those to storage which will not be used on the new setup. Clean and inspect all toolslides and tool mounting surfaces on the machine for nicks and burrs or any signs of abnormal wear. Do not use air hose to clean the machine. Set any remaining tools in their toolholders as described above.

Review the Tooling Setup Chart and the machine in reference to the attachments required as opposed to those now on the machine. Remove those that are not required for the new setup; clean, oil and send them to storage. Do not allow tools, toolholders, attachments, cams or gages not in use to accumulate around the machine.

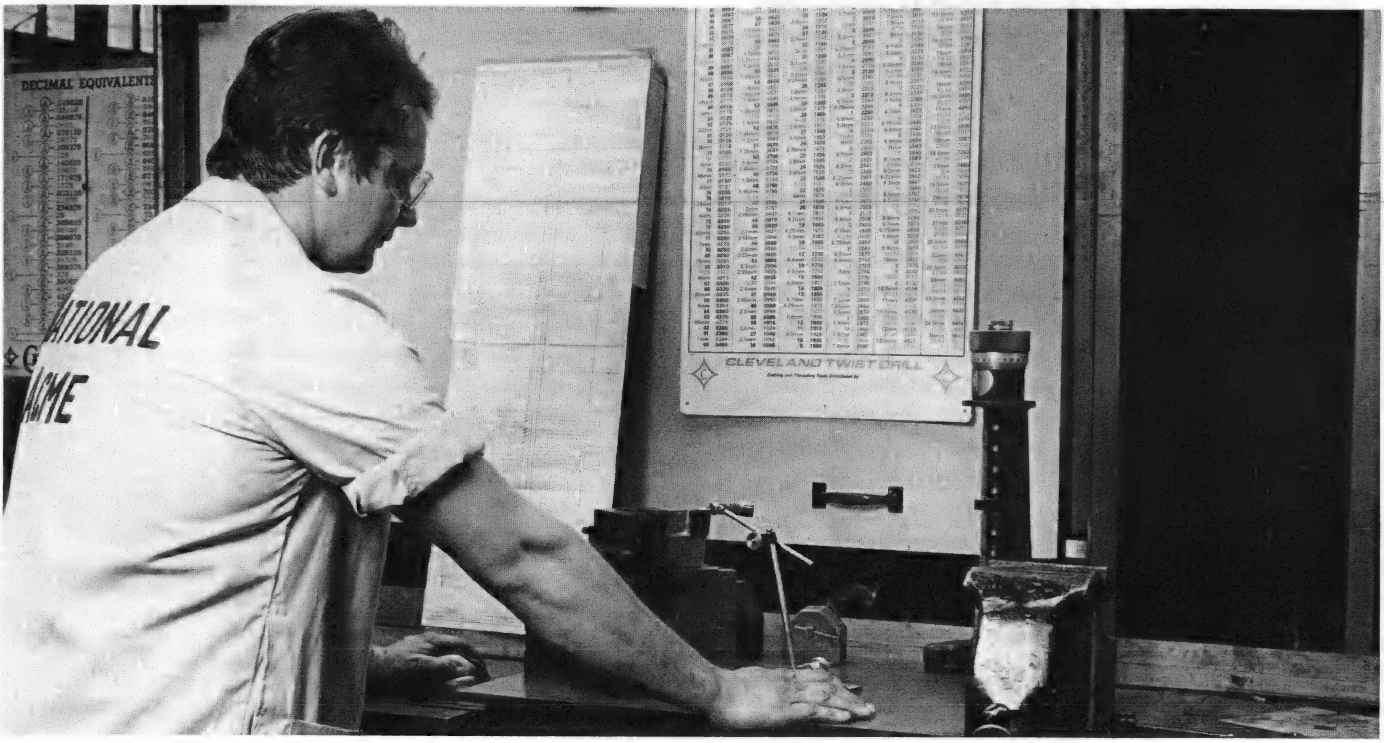


Fig. D-1. Prepare for next setup at your bench.

TOOLING SETUP CHART

NOTE: The following setup instructions are prepared for a 2⅝" RB-6 machine. They are general in nature and do not necessarily apply to all models and sizes of Acme-Gridley Multiple Spindle Bar Machines.

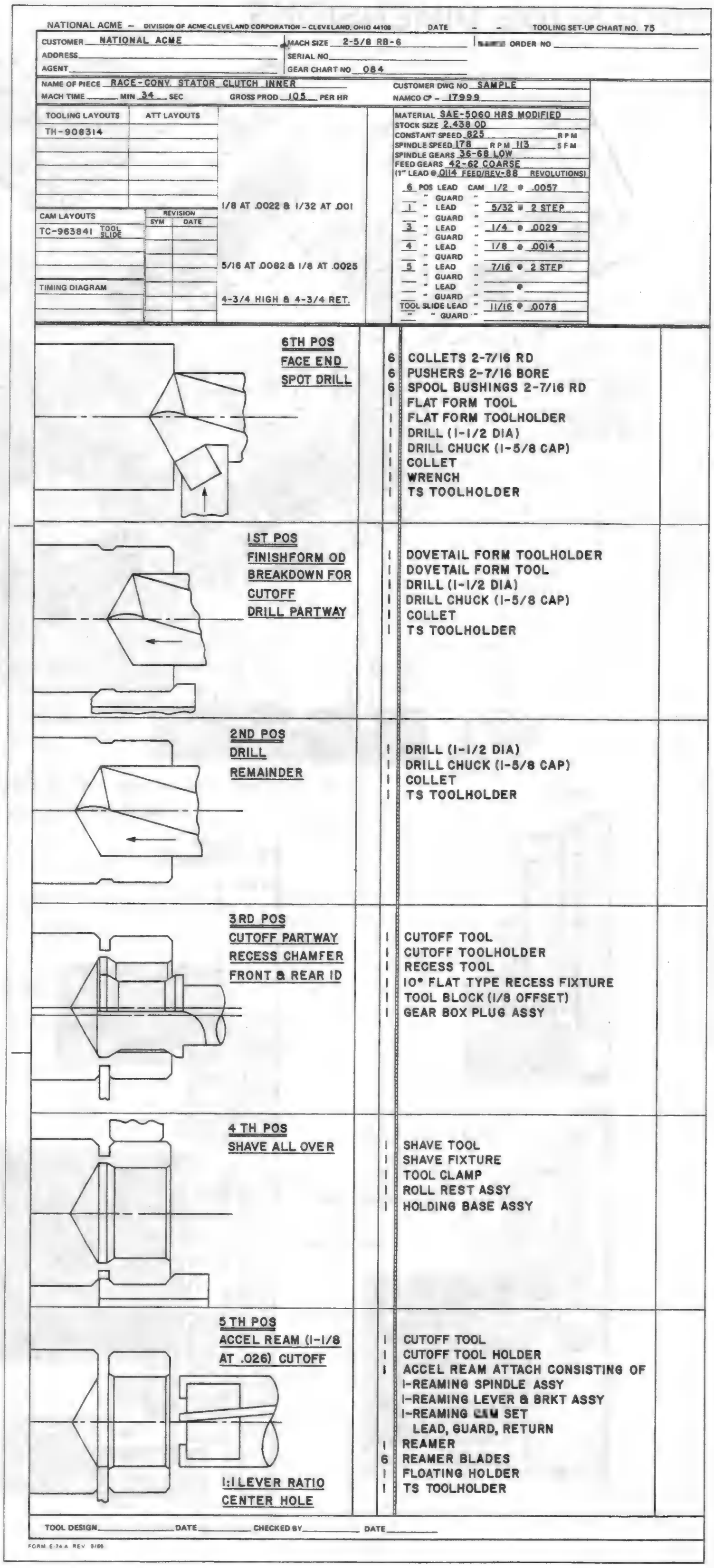
The Tooling Setup Chart (Fig. D-2) is the starting point for setting up any job. It identifies the part to be manufactured, the sequence of machine operations and the specific material from which the part is to be made. It also specifies the collets, pushers, spool bushings, spindle speed and feed change gears, cams, toolholders and accessories to be used on each slide. Other data include spindle RPM, surface feet per minute, feed rates and cycle time. In some cases, tool locating dimensions are also supplied.

Data about the required tools and attachments are listed in the body of the Tooling Setup Chart. To the left are sketches and descriptions of the operations at each position. To the right are detail lists of the required tools and attachments.

CAUTION: Your safety is important. Read the Safety section of this handbook before performing any of the following setup procedures.

CAUTION: Main disconnect must be in OFF position before making any adjustments.

CAUTION: The labor and time required to set up a machine can be greatly reduced by the careful use of the JOG mode. However, if the machine must be cranked, extreme caution must be exercised to insure that the main disconnect is in the OFF position before engaging the *hand crank*. The *hand crank* must always be removed from the worm shaft when not cranking the machine and before starting the main drive motor.



NATIONAL ACME – DIVISION OF ACME-CLEVELAND CORPORATION – CLEVELAND, OHIO 44108 DATE – – TOOLING SET-UP CHART NO. 75

CUSTOMER NATIONAL ACME
ADDRESS
AGENT
MACH SIZE 2-5/8 RB-6
SERIAL NO
GEAR CHART NO 084
[redacted] ORDER NO

NAME OF PIECE RACE-CONV. STATOR CLUTCH INNER
MACH TIME MIN 34 SEC
GROSS PROD 105 PER HR
CUSTOMER DWG NO SAMPLE
NAMCO CP – 17999

TOOLING LAYOUTS TH-908314
ATT LAYOUTS
CAM LAYOUTS TC-963841 TOOL SLIDE
REVISION SYM DATE
TIMING DIAGRAM

1/8 AT .0022 & 1/32 AT .001
5/16 AT .0082 & 1/8 AT .0025
4-3/4 HIGH & 4-3/4 RET.

MATERIAL SAE-5060 HRS MODIFIED
STOCK SIZE 2.438 OD
CONSTANT SPEED 825 RPM
SPINDLE SPEED 178 RPM 113 SFM
SPINDLE GEARS 36-68 LOW
FEED GEARS 42-62 COARSE
(1" LEAD @ .0114 FEED/REV-88 REVOLUTIONS)

6 POS	LEAD	CAM 1/2	@ .0057
"	GUARD	"	
1 "	LEAD	" 5/32	@ 2 STEP
"	GUARD	"	
3 "	LEAD	" 1/4	@ .0029
"	GUARD	"	
4 "	LEAD	" 1/8	@ .0014
"	GUARD	"	
5 "	LEAD	" 7/16	@ 2 STEP
"	GUARD	"	
"	LEAD	"	@
"	GUARD	"	
TOOL SLIDE	LEAD	" 11/16	@ .0078
"	GUARD	"	

6TH POS
FACE END
SPOT DRILL

6	COLLETS 2-7/16 RD
6	PUSHERS 2-7/16 BORE
6	SPOOL BUSHINGS 2-7/16 RD
1	FLAT FORM TOOL
1	FLAT FORM TOOLHOLDER
1	DRILL (1-1/2 DIA)
1	DRILL CHUCK (1-5/8 CAP)
1	COLLET
1	WRENCH
1	TS TOOLHOLDER

1ST POS
FINISHFORM OD
BREAKDOWN FOR CUTOFF
DRILL PARTWAY

1	DOVETAIL FORM TOOLHOLDER
1	DOVETAIL FORM TOOL
1	DRILL (1-1/2 DIA)
1	DRILL CHUCK (1-5/8 CAP)
1	COLLET
1	TS TOOLHOLDER

2ND POS
DRILL
REMAINDER

1	DRILL (1-1/2 DIA)
1	DRILL CHUCK (1-5/8 CAP)
1	COLLET
1	TS TOOLHOLDER

3RD POS
CUTOFF PARTWAY
RECESS CHAMFER
FRONT & REAR ID

1	CUTOFF TOOL
1	CUTOFF TOOLHOLDER
1	RECESS TOOL
1	10° FLAT TYPE RECESS FIXTURE
1	TOOL BLOCK (1/8 OFFSET)
1	GEAR BOX PLUG ASSY

4 TH POS
SHAVE ALL OVER

1	SHAVE TOOL
1	SHAVE FIXTURE
1	TOOL CLAMP
1	ROLL REST ASSY
1	HOLDING BASE ASSY

5 TH POS
ACCEL REAM (1-1/8 AT .026) CUTOFF
1:1 LEVER RATIO
CENTER HOLE

1	CUTOFF TOOL
1	CUTOFF TOOL HOLDER
1	ACCEL REAM ATTACH CONSISTING OF 1-REAMING SPINDLE ASSY 1-REAMING LEVER & BRKT ASSY 1-REAMING CAM SET LEAD, GUARD, RETURN
1	REAMER
6	REAMER BLADES
1	FLOATING HOLDER
1	TS TOOLHOLDER

TOOL DESIGN______ DATE______ CHECKED BY______ DATE______

FORM E-74-A REV 9/66

Fig. D-2. Typical Tooling Setup Chart.

TOOLSLIDE DIMENSIONS

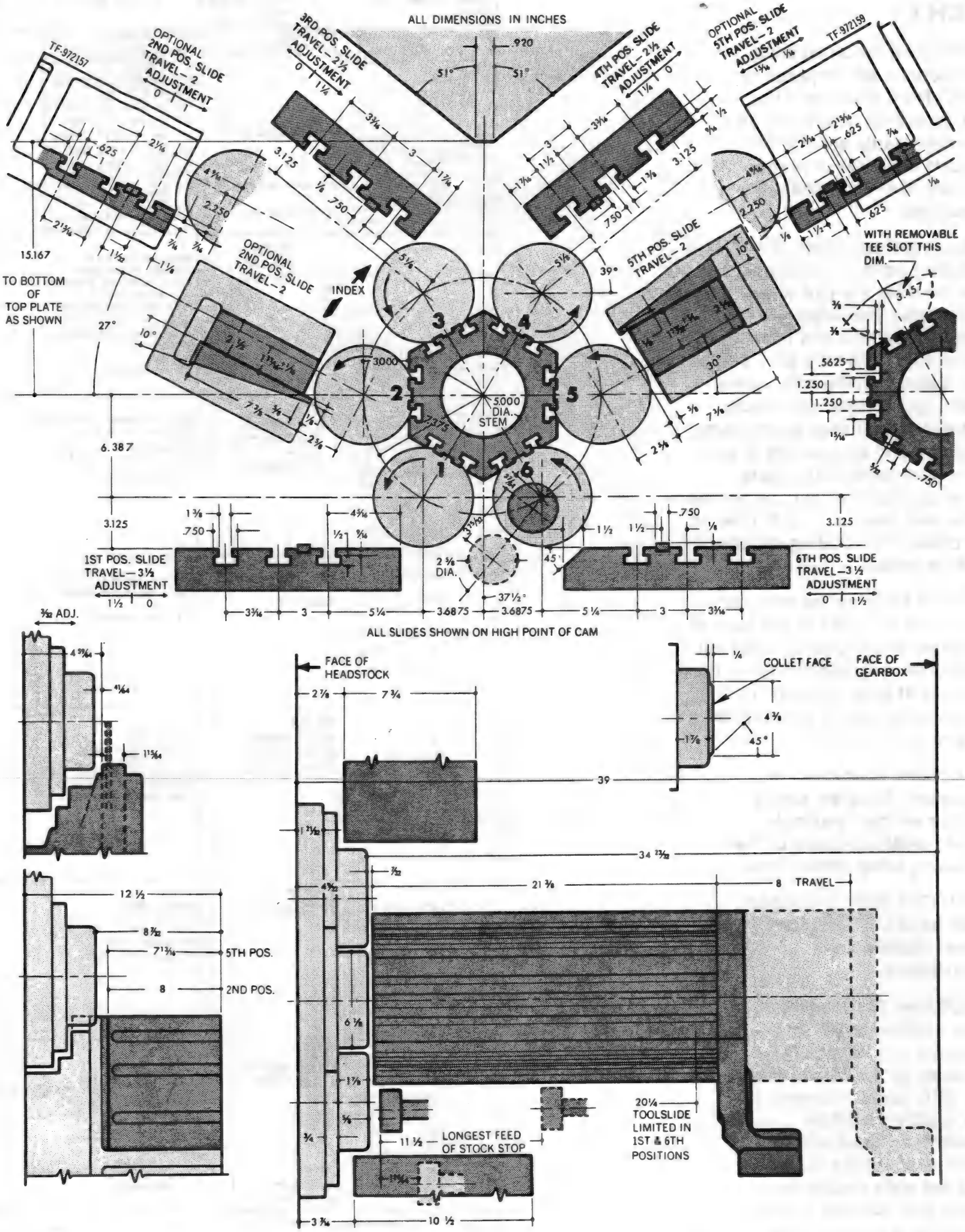

ALL DIMENSIONS IN INCHES
TF-972157
OPTIONAL 2ND POS. SLIDE TRAVEL—2 ADJUSTMENT
3RD POS. SLIDE TRAVEL—2½ ADJUSTMENT
4TH POS. SLIDE TRAVEL—2½ ADJUSTMENT
OPTIONAL 5TH POS. SLIDE TRAVEL—2 ADJUSTMENT
TF-972159
.920
51°
51°
15.167
TO BOTTOM OF TOP PLATE AS SHOWN
OPTIONAL 2ND POS. SLIDE TRAVEL—2
INDEX
5TH POS. SLIDE TRAVEL—2
WITH REMOVABLE TEE SLOT THIS DIM.
3.457
27°
39°
30°
6.387
3.125
3.000
5.000 DIA. STEM
7.375
.5625
1.250
1.250
.750
.625
2.250
1ST POS. SLIDE TRAVEL—3½ ADJUSTMENT
6TH POS. SLIDE TRAVEL—3½ ADJUSTMENT
2⅜ DIA.
37½°
3.6875
3.6875
45°
ALL SLIDES SHOWN ON HIGH POINT OF CAM
3/32 ADJ.
12½
5TH POS.
8
2ND POS.
FACE OF HEADSTOCK
COLLET FACE
FACE OF GEARBOX
39
45°
34 23/32
21⅜
8 TRAVEL
20¼ TOOLSLIDE LIMITED IN 1ST & 6TH POSITIONS
LONGEST FEED OF STOCK STOP
11½
10½

Fig. D-3. These toolslide dimensions are for a 2⅝" RB-6 machine starting with serial number 84846-A (registering keys added to cross slides). For toolslide dimensions of other models, refer to *Acme-Gridley Multiple Spindle Bar Machine Manual Supplement.*

SETUP PROCEDURES

1. Change Stock Feed Cams

CAUTION: Main disconnect must be in OFF position while performing this step.

Check to see whether the stock feed cams from the previous setup are the same as the ones required for the current setup. If so, skip Steps 1A thru 1E.

If the machine is equipped with an adjustable stock feed, refer to Appendix (section H, page 2) of this handbook for the procedure to follow in place of the procedure detailed here.

1A. Relieve Stock Feed Spring Tension

Crank the machine until the *stock feed slide roll* reaches the bottom of the *stock feed cam.* (Fig. D-4) CHECK TO BE SURE THE *SPRING RETAINING SAFETY PIN* IS IN THE LAST HOLE OF THE *STOCK FEED SPRING HOUSING.* (Fig. D-5)

Compress the *stock feed spring* slightly by inching it toward the *work spindle* using a heavy-duty screw driver inserted in one of the holes in the side of the *stock feed spring housing.* (Fig. D-5) When the pressure on the *spring retaining pin* is released, remove the pin.

Repeat the above procedure to remove the *spring retaining safety pin.*

CAUTION: Provide a means to keep the stock feed spring from flying out the end of the stock feed spring housing when the spring retaining safety pin is removed.

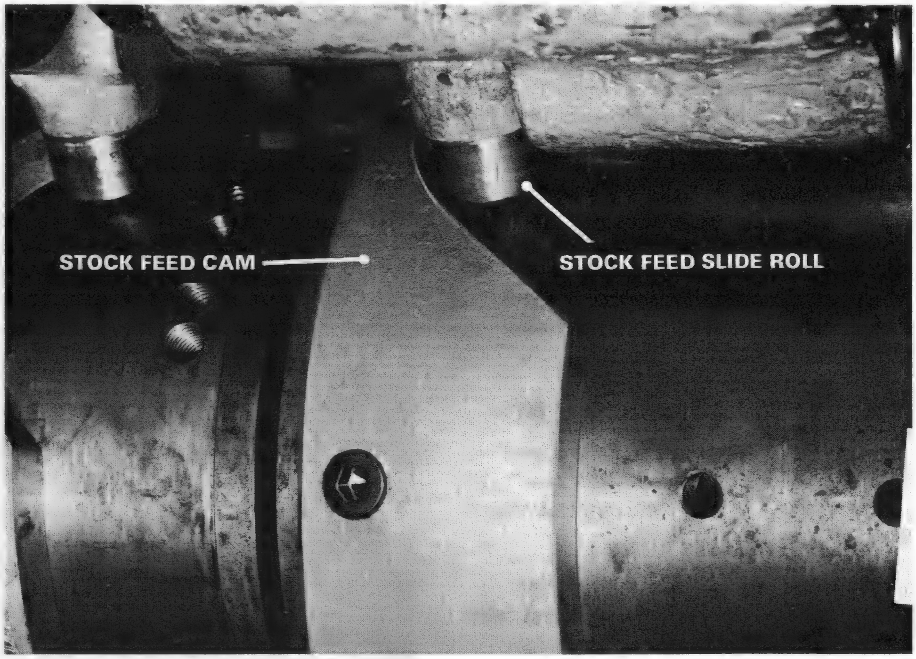


Fig. D-4. Position stock feed slide roll at bottom of stock feed cam.

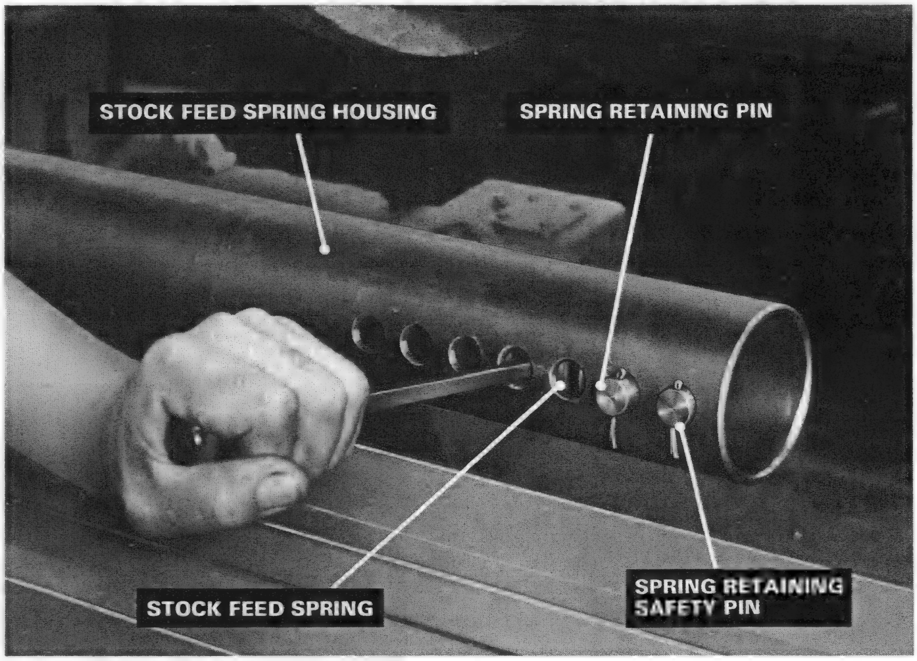


Fig. D-5. Use a heavy-duty screw driver to compress stock feed spring.

1B. Move Aligning Disc Out of Way

Loosen the *aligning disc positioning screw.* Push the *aligning disc* and the *stock feed slide* back toward the *stock reel.* (Fig. D-6)

1C. Replace Stock Feed Cam

Remove the *stock feed* and *stock feed return cams.* (Fig. D-7) Install the new cams in the same position as the old cams.

1D. Reposition Aligning Disc

Crank the machine until the *stock feed slide roll* is in line with the highest point of the *stock feed return cam.* (Fig. D-7)

Move the *stock feed slide* forward until the *stock feed slide roll* contacts the highest point of the *stock feed return cam.* Position the *aligning disc assembly* over the ends of the *pusher tubes* allowing a minimum of 1/16-inch clearance between the *wear plate* and the *pusher tube spool* to permit free rotation of *pusher tubes.* (Fig. D-8) Tighten and lock the *aligning disc positioning screw.*

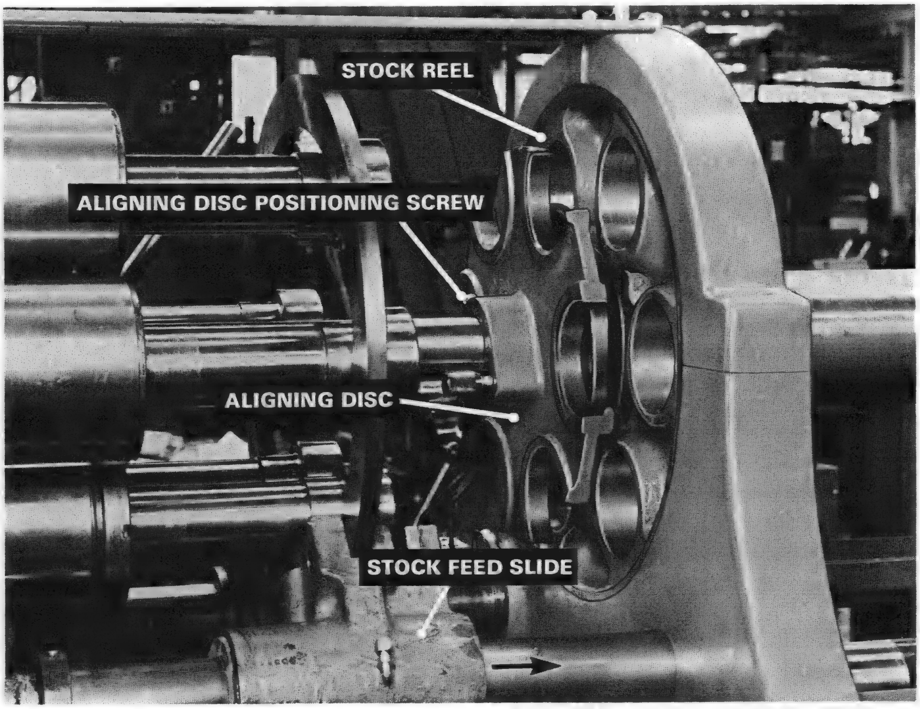

STOCK REEL
ALIGNING DISC POSITIONING SCREW
ALIGNING DISC
STOCK FEED SLIDE

Fig. D-6. Push aligning disc and stock feed slide out of the way.

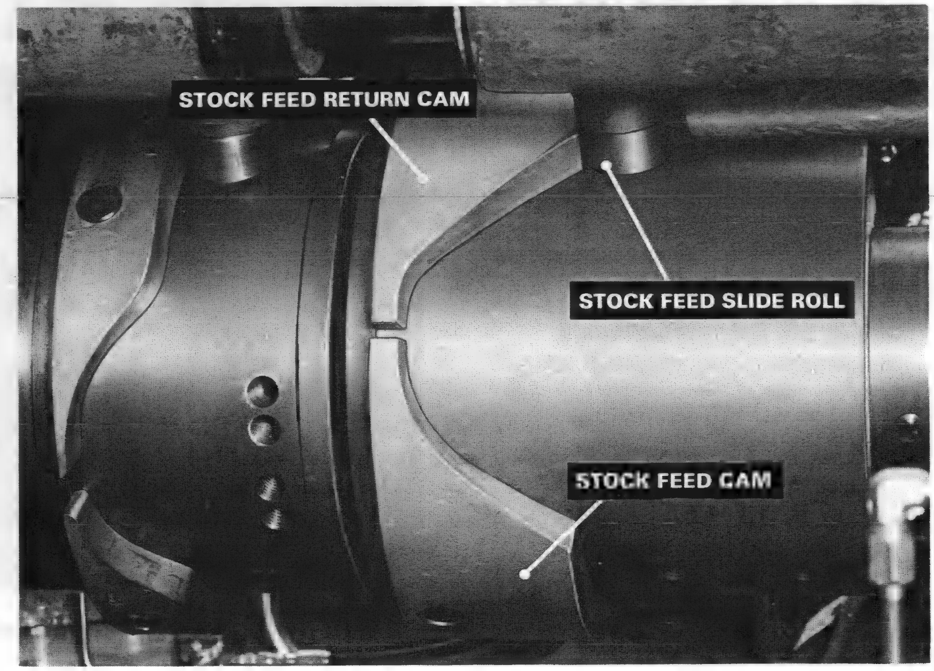

STOCK FEED RETURN CAM
STOCK FEED SLIDE ROLL
STOCK FEED CAM

Fig. D-7. Position highest point of stock feed return cam opposite stock feed slide roll.

On large machines, spot drilled holes are provided on the *aligning disc shaft* for locating the aligning disc assembly — one hole for each standard *stock feed cam.* (Fig. D-9) If a special height *stock feed cam* is used, a new spot drilled hole must be provided. When positioning the *aligning disc* on these machines, the *aligning disc positioning screw* must be bottomed in the spot drilled hole which provides the required 1/16-inch minimum clearance on the pusher tubes.

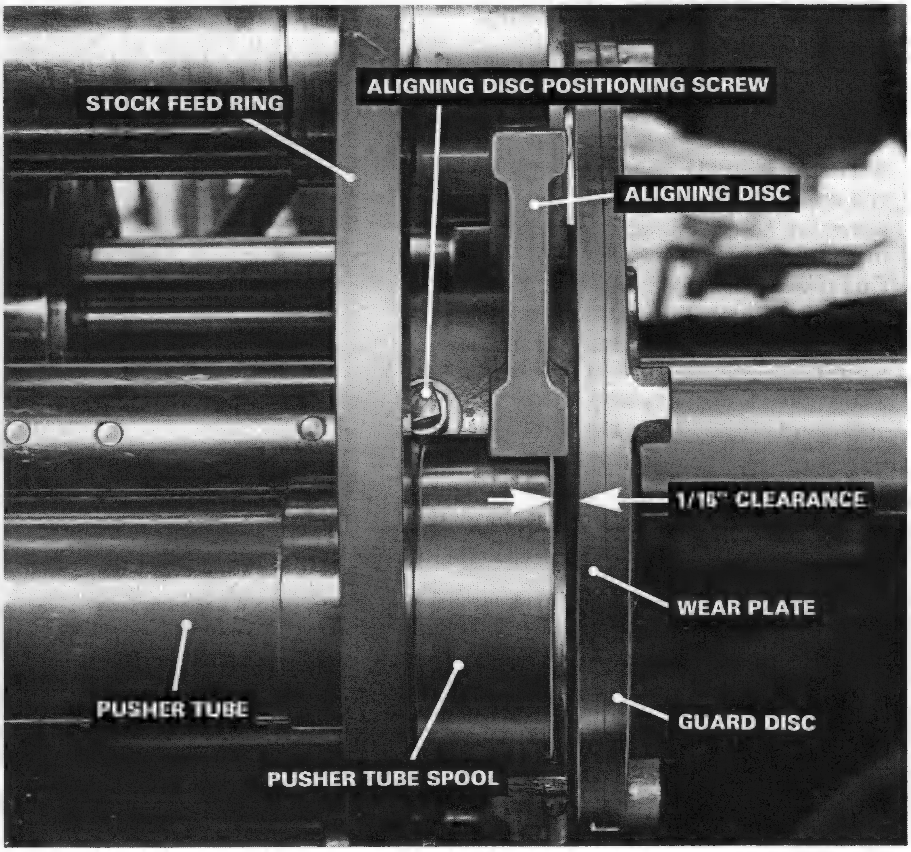

STOCK FEED RING
ALIGNING DISC POSITIONING SCREW
ALIGNING DISC
1/16" CLEARANCE
WEAR PLATE
GUARD DISC
PUSHER TUBE
PUSHER TUBE SPOOL

Fig. D-8. Position aligning disc assembly to allow 1/16-inch minimum clearance.

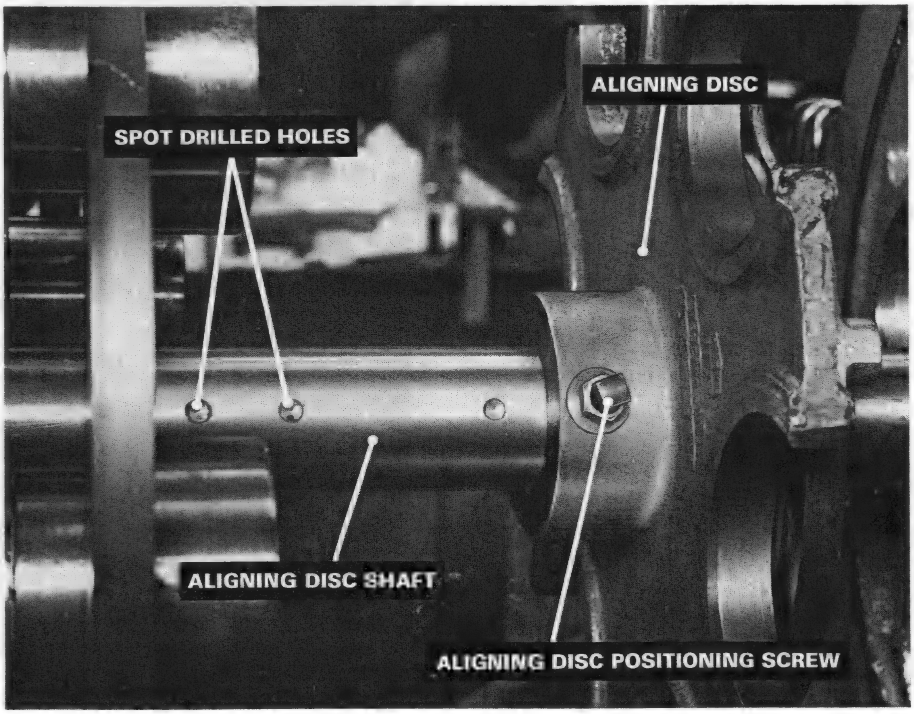

ALIGNING DISC
SPOT DRILLED HOLES
ALIGNING DISC SHAFT
ALIGNING DISC POSITIONING SCREW

Fig. D-9. Locate aligning disc positioning screw in spot drilled hole.

1E. Reset Stock Feed Spring Tension

Crank the machine until the *stock feed slide roll* is in line with the bottom of the *stock feed cam.* Move the *stock feed slide* forward until its *roll* contacts the *stock feed cam.* Move the *stock feed spring* forward in its tube as far as it will go. Compress the *stock feed spring* using two heavy-duty screw drivers. (Fig. D-10) As soon as the end of the spring has passed the end hole in the *stock feed spring housing,* insert the *spring retaining safety pin* in the end hole. Continue compressing the spring until adequate tension is established to feed bars properly. Replace the *spring retaining pin* to keep the spring compressed. Remove the screw drivers.

CAUTION: Never remove the spring retaining safety pin after spring tension has been set.

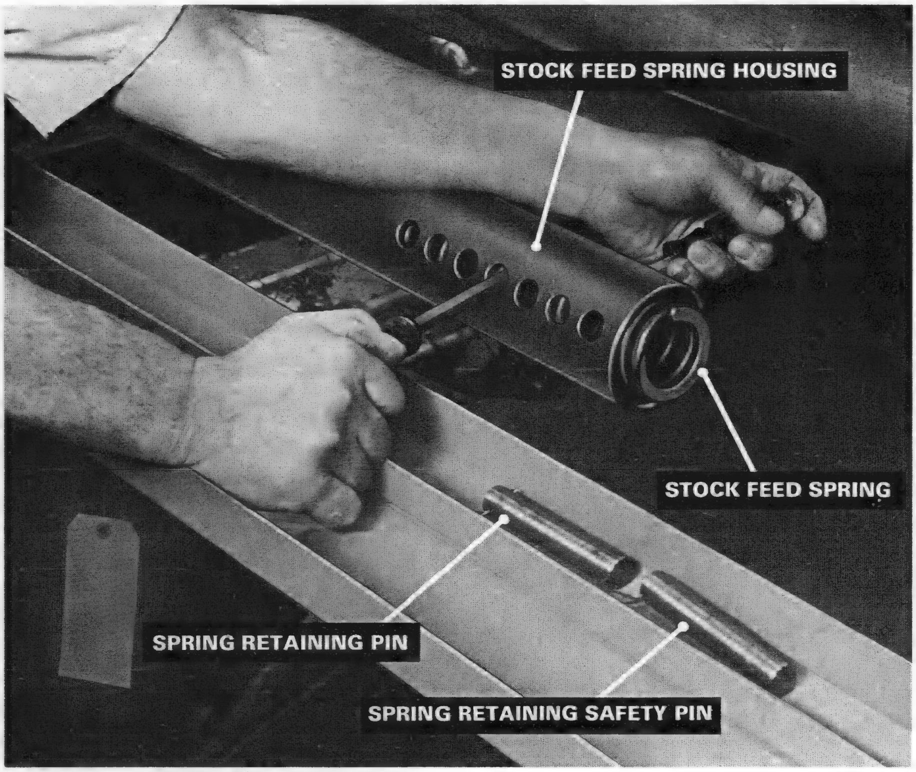


Fig. D-10. Use two heavy-duty screw drivers to compress stock feed spring.

2. Remove Collets, Pushers and Spool Bushings

CAUTION: Main disconnect must be in OFF position while performing this step.

2A. Remove Stock Feed Pusher Tube and Pusher

Remove the front section of the *finger holder oil guard* to permit access to the finger holder area. (Fig. D-11) Crank the machine forward or backward (depending on where it had been stopped previously) until the *stock feed slide* is in the full forward position (toward the spindle).

Release the *stock reel tube* in the first position and pull the tube fully back (Fig. D-11), providing room to remove the assembled *pusher tube* and *pusher* from the machine.

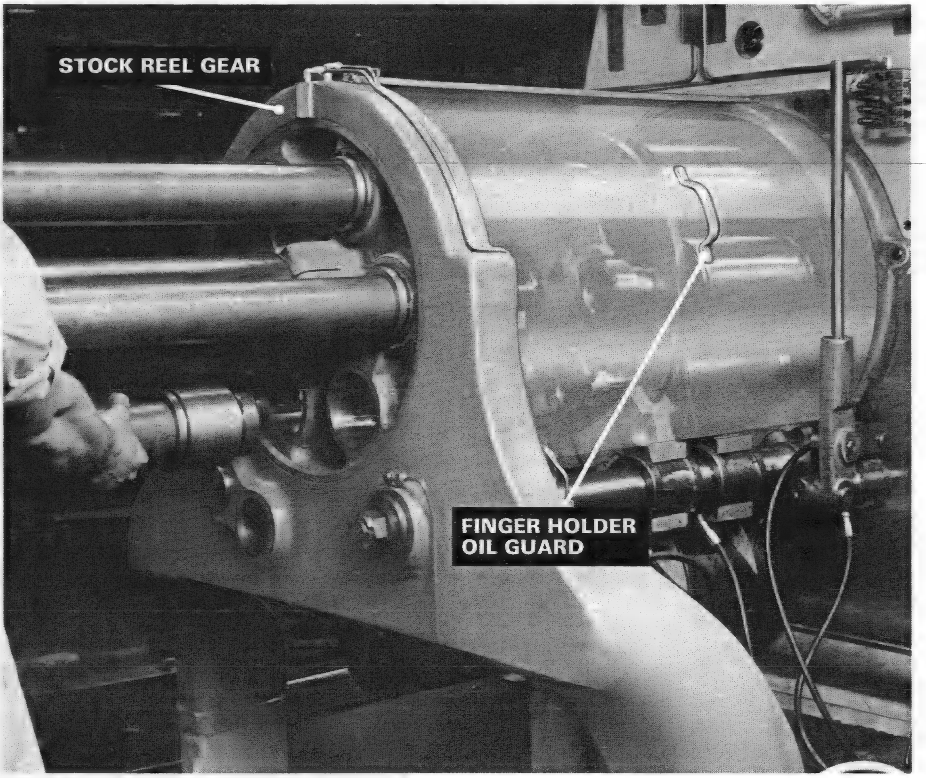


Fig. D-11. Remove front section of finger holder oil guard and pull stock reel tube fully back.

Release the *guard disc locking pin* (Fig. D-12) and rotate the *guard disc* until the notch lines up with the first position *stock feed pusher spool.* (Fig. D-13) Withdraw the assembled pusher tube and pusher from the machine thru the notch in the *guard disc* and thru the *stock reel gear.* (Fig. D-11)

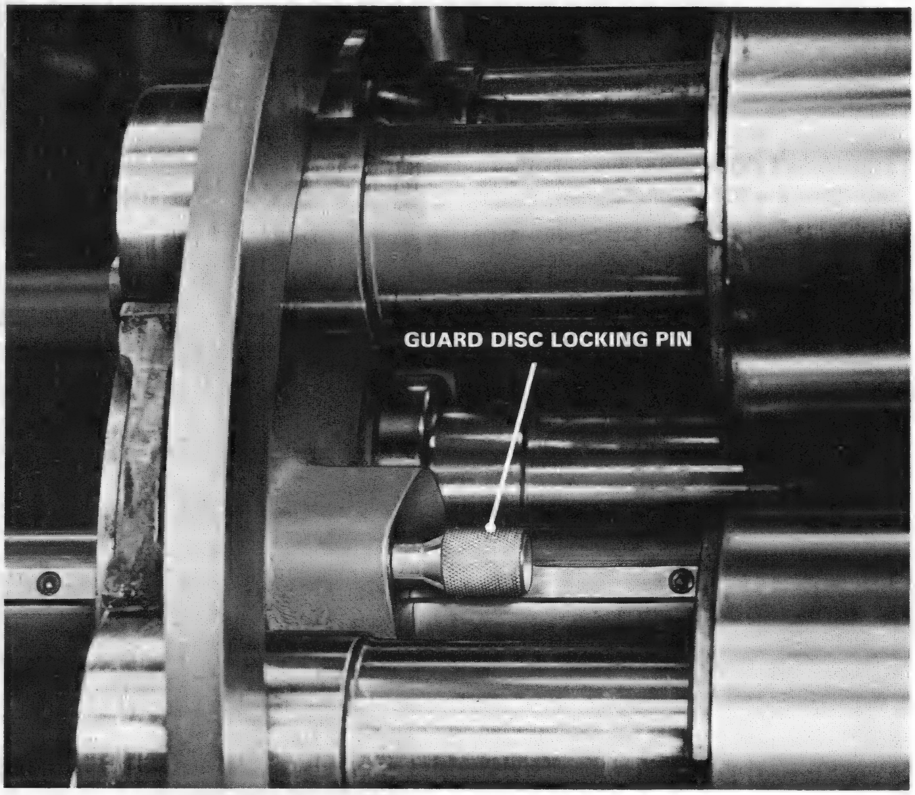

GUARD DISC LOCKING PIN

Fig. D-12 Release guard disc locking pin.

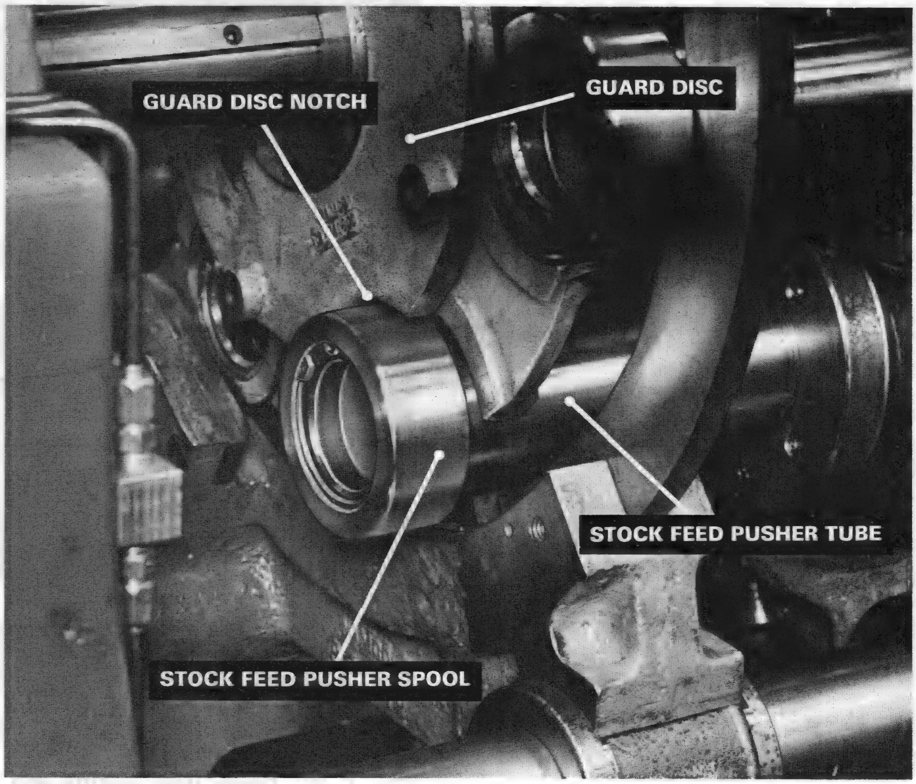
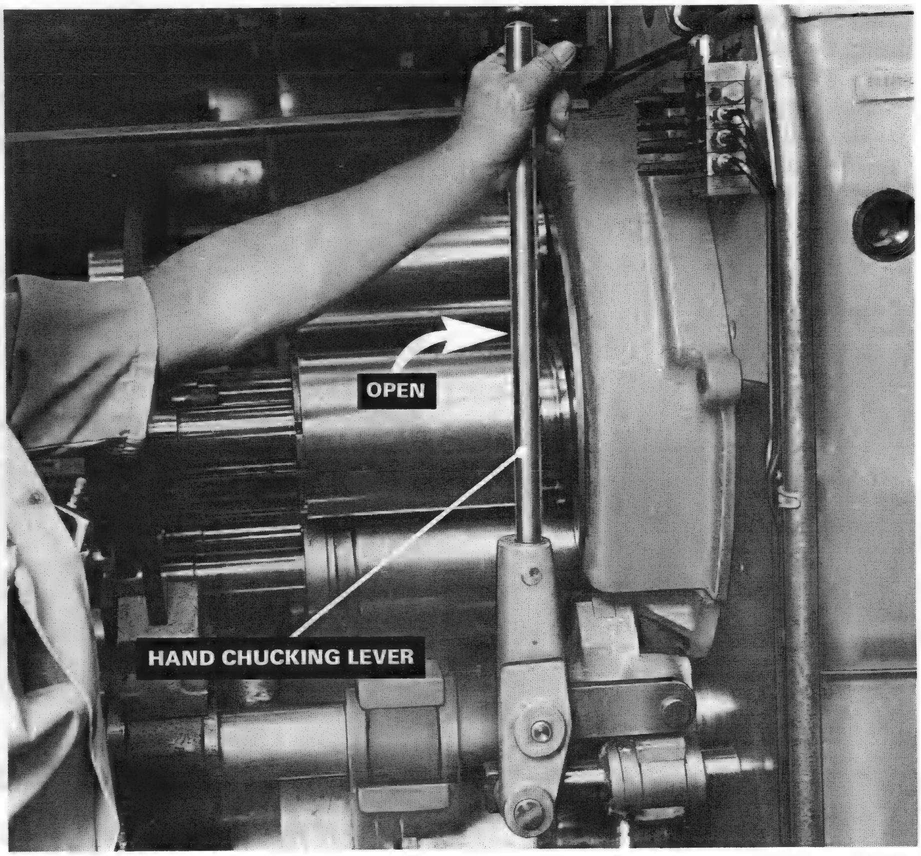

GUARD DISC NOTCH
GUARD DISC
STOCK FEED PUSHER TUBE
STOCK FEED PUSHER SPOOL

Fig. D-13. Withdraw stock feed pusher tube.

Move the *hand chucking lever* to the right (open position), opening the collet in the first position (hand chucking is air operated on some machines). (Fig. D-14) Remove the butt end of stock from the previous job (thru the tooling area).


OPEN
HAND CHUCKING LEVER

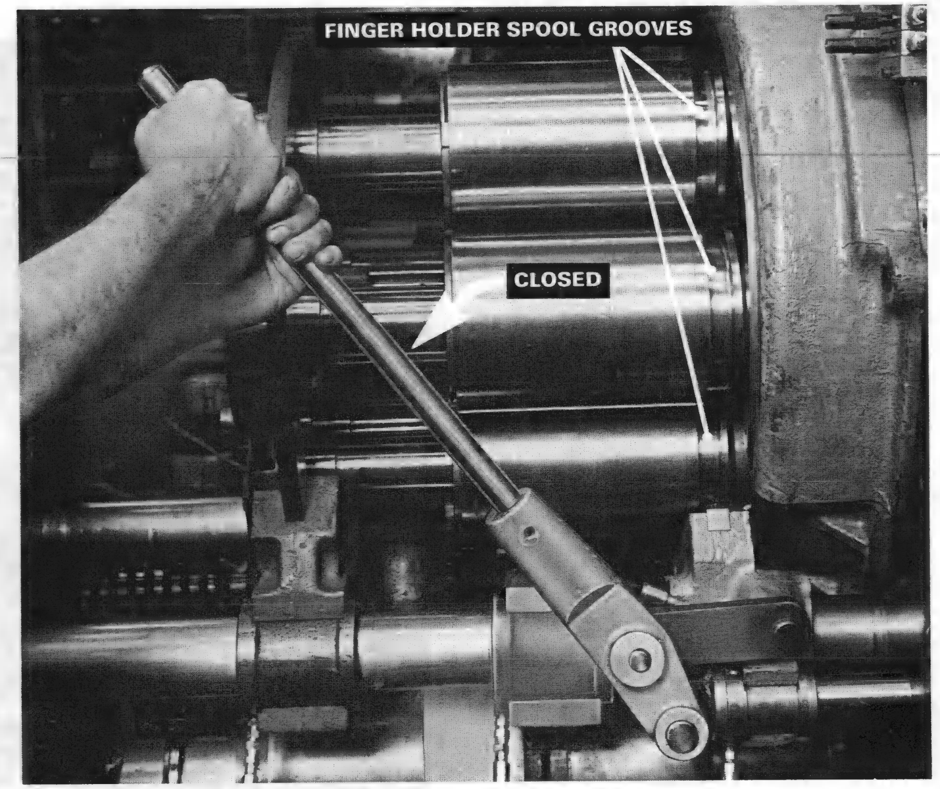

FINGER HOLDER SPOOL GROOVES
CLOSED

Fig. D-14. Open (top photo) and closed (bottom photo) positions of hand chucking lever.

2B. Remove First Collet and Collet Tube

Collets are removed, replaced or adjusted in the first position only. Crank the machine forward or backward so the *stock feed slide* moves away from the *work spindle,* offering clear access to the *collet tube nut locking pin.* If short stock feed cams are on the machine, it may be necessary to remove the stock feed spring (See Step 1A.) and manually move the stock feed slide for better accessibility. Pry the *collet tube nut locking pin* out of its slot (Fig. D-15) far enough to rotate it one-quarter turn (Fig. D-18) preventing it from going back into the slot.

Rotate the *collet tube nut* with a spanner wrench to unscrew the *collet tube* from the *collet* (left-hand thread on all machines except 2⅝" RB-6 and 2⅝" RB-8 models). (Fig. D-16) If spindles persist in turning, use ⅝-inch copper tubing as a wedge in the gear teeth to hold the spindles so the collet tube can turn in the collet.

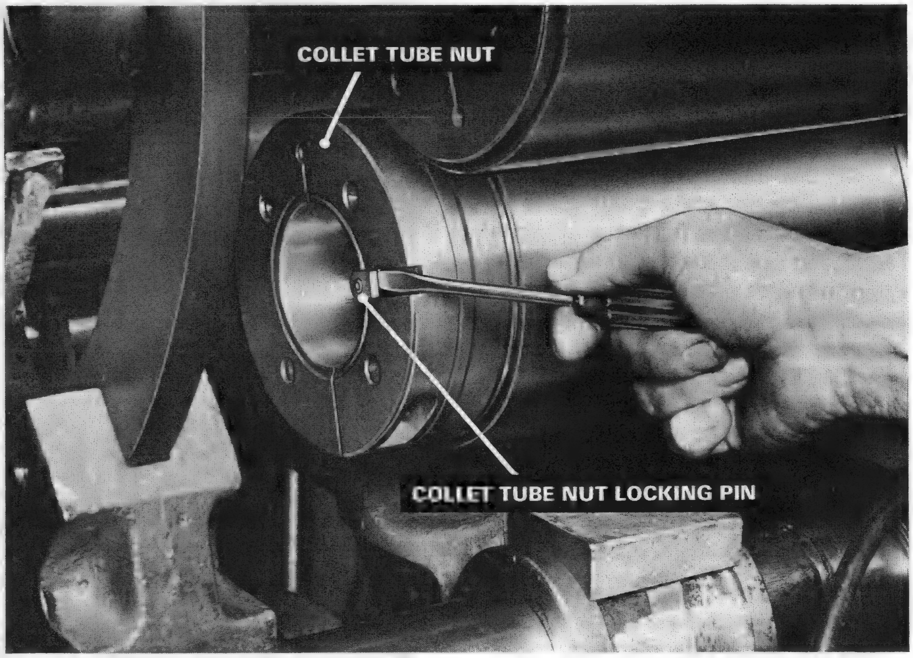


Fig. D-15. Pry collet tube nut locking pin out of its slot and rotate one-quarter turn.

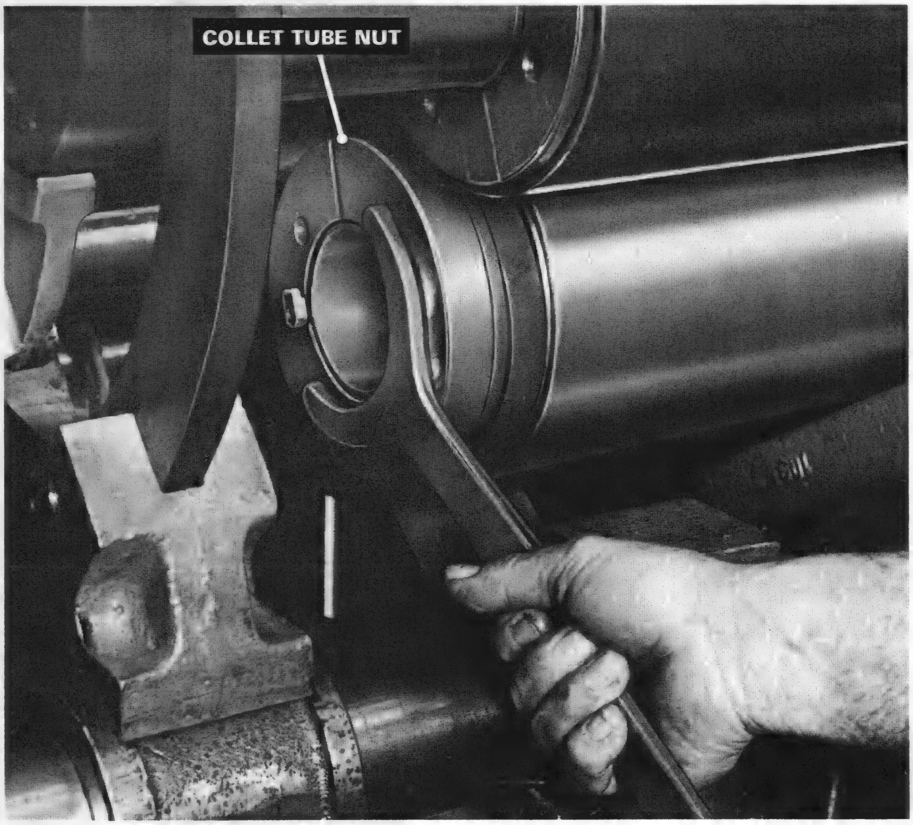


Fig. D-16. Rotate collet tube nut with spanner wrench.

Remove the *collet* from the *work spindle nose.* (Fig. D-17)

Release the *clamping screw* in the *collet tube nut* and remove the *collet tube nut* from the *collet tube.* (Fig. D-18) Use a spanner wrench for the *collet tube nut* while holding the *collet tube* with a hand towel (*collet tube* and *collet tube nut* have right-hand threads). The *collet tube* will now slide freely out of the machine toward the stock reel.

CAUTION: Exercise care when removing the collet tube so as not to damage the collet tube threads.

2C. Clean Space Between Collet Tube and Work Spindle

Cleanliness in this area contributes greatly to troublefree stock feeding. With the *collet tube* removed, wipe the internal diameter of the *work spindle* clean. (Fig. D-19) Pay particular attention to the area immediately behind the collet seat and the holes in the *work spindle nose.*

CAUTION: Do not remove the collet seat or collet seat pin.

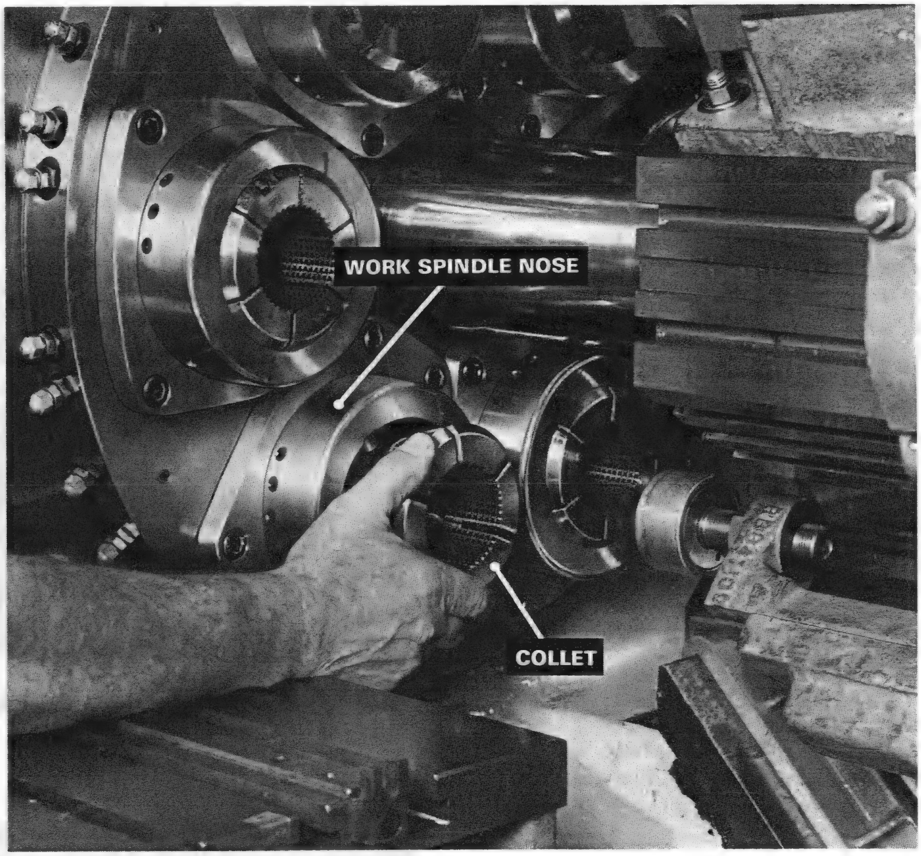


Fig. D-17. Remove collet from spindle nose.

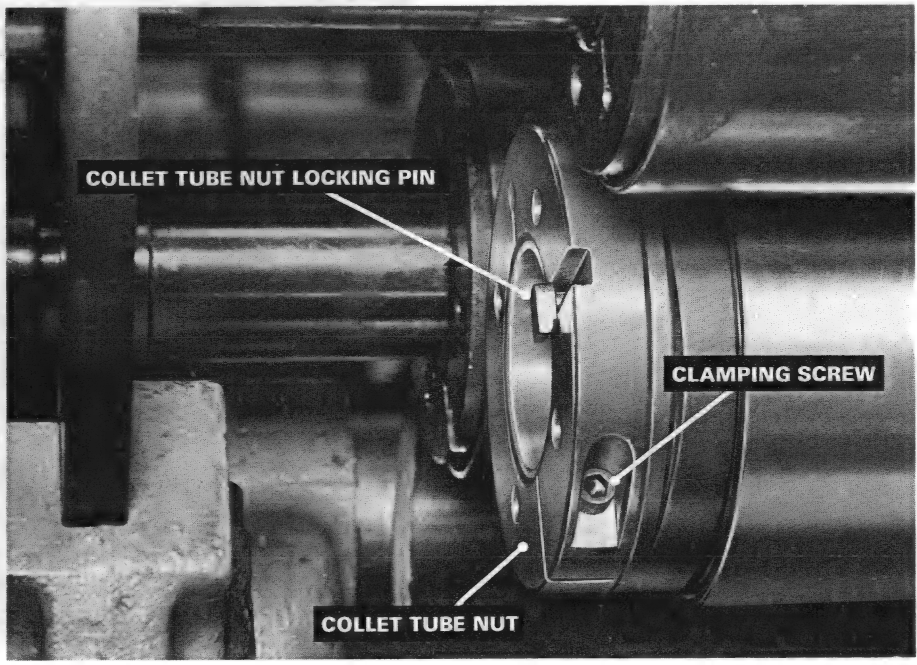


Fig. D-18. Release clamping screw in collet tube nut. Collet tube nut locking pin is shown in unlocked position.

After thoroughly cleaning the *work spindle*, generously lubricate the *collet operating fingers, spool and finger holder body* while manually operating the *chucking spool* with the *hand chucking lever.*

Lightly lubricate the *collet seat* and the entire inside surface of the *work spindle* to prevent rust and assure free movement of the *collet* and *collet tube.* Use general purpose lubricating oil.

2D. Clean and Replace Collet Tube

Clean the inside and outside of the *collet tube.* Remove any burrs or build up of dirt on the threads. Wipe the inside and outside of the *collet tube* with a clean hand towel saturated in general purpose lubricating oil.

Position *collet tube* in *stock reel gear* and *aligning disc* as shown in Fig. D-20. Place *spacer, compensating spring* and *thrust plate,* in the sequence shown, on end of *collet tube* before end of *collet tube* is inserted into *work spindle.* Be sure aligning hole in *thrust plate* is lined up with *aligning pin* in *finger holder body.*

Slide the lubricated collet tube into the *work spindle* from the stock reel end of the machine, taking care not to damage the thread. Clean the *collet tube nut,* lubricate the threads and install on the *collet tube,* making sure it will end up next to the *finger holder* when it is in its adjusted position. Screw the *collet tube nut* on the *collet tube* for two-thirds the length of the nut. Tighten the *clamping screw* on the *collet tube nut* to temporarily clamp the *nut* firmly to the *collet tube* in this position. (Fig. D-18)

> **CAUTION: Overtightening the collet tube nut clamping screw can collapse the collet tube.**

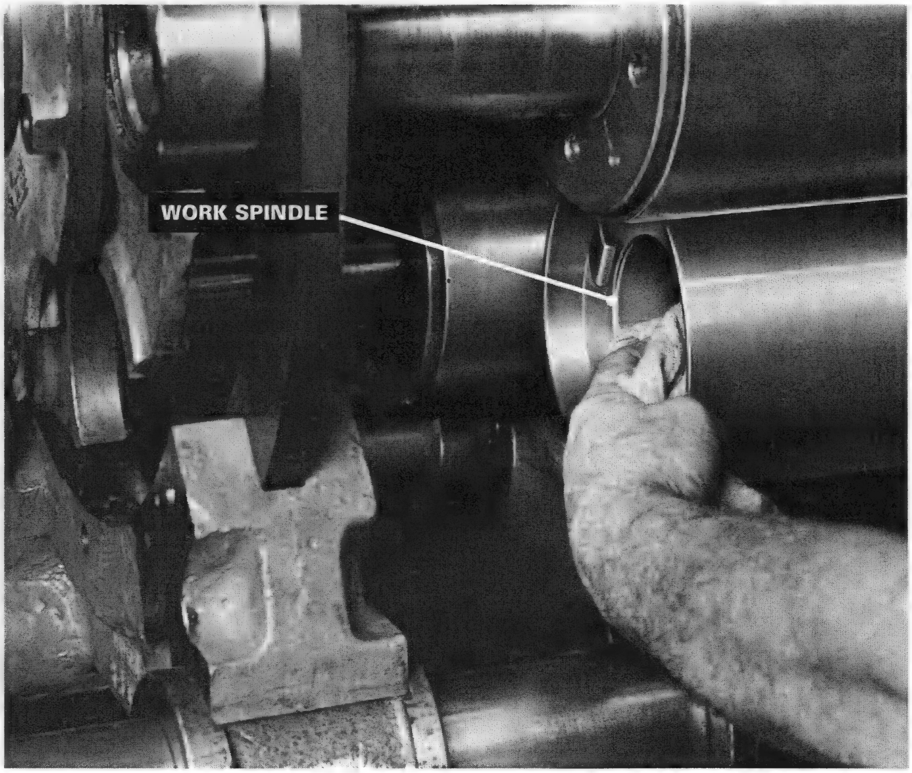


Fig. D-19. Clean space between collet tube and work spindle.

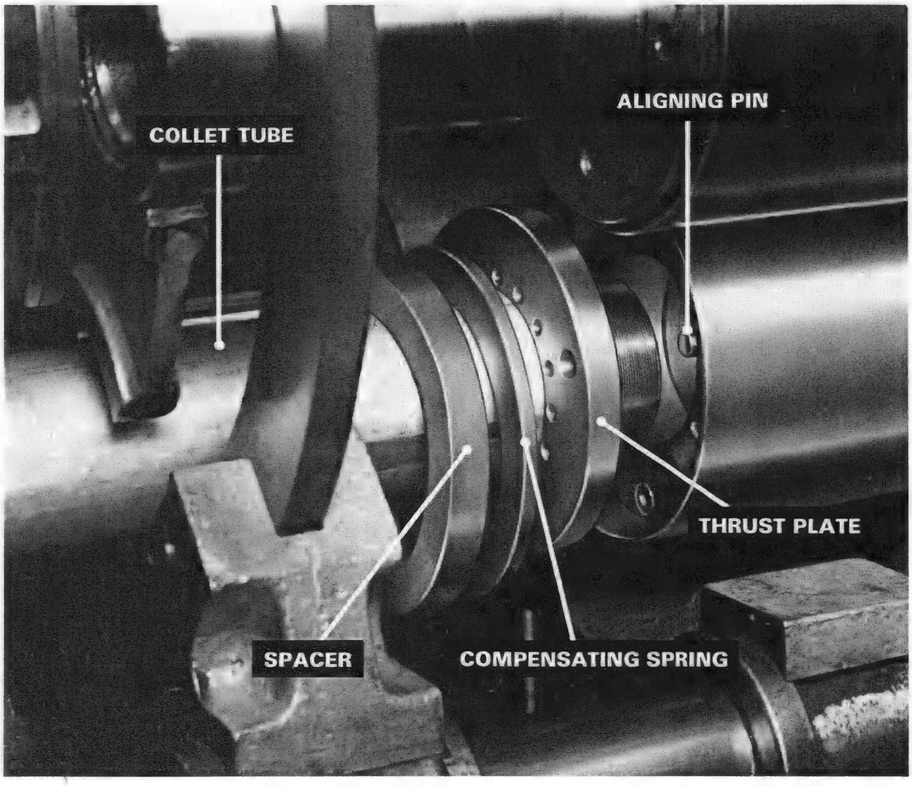


Fig. D-20. Place spacer, compensating spring and thrust plate on end of collet tube.

3. Install Correct Collets, Pushers and Spool Bushings

CAUTION: Main disconnect must be in OFF position while performing this step.

3A. Install Collet

Select the correct *collet* for the job as specified on the Tooling Setup Chart. Check the *collet* to be sure it is clean and well lubricated. Insert the *collet* into the *work spindle nose.* (Fig. D-21) Slide the *collet* fully into the *work spindle,* aligning the *locating slot* of the *collet* with the *collet seat pin* so that the *collet* fits snugly into the collet seat.

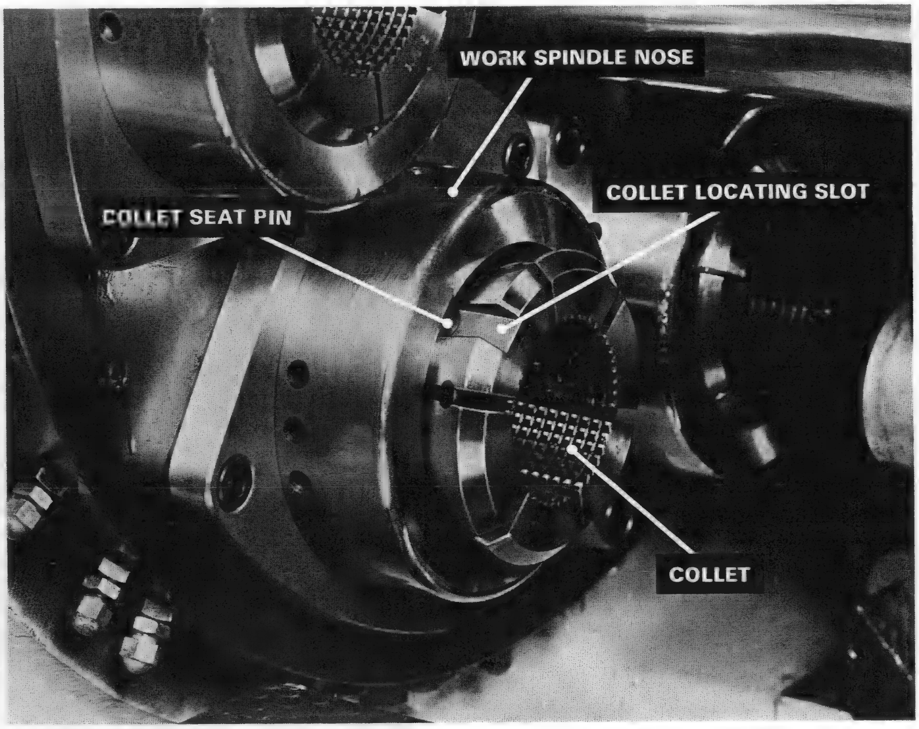


Fig. D-21. Align locating slot of collet with collet seat pin.

Hold the *collet* lightly in its fully inserted position and slowly advance the *collet tube* to the *collet,* turning the *collet tube* and *nut* slowly to engage the threads of the *collet* (left-hand thread on all machines except 2⅝″ RB-6 and 2⅝″ RB-8 models). When you are certain that the threads have engaged properly and the *collet tube* is turning freely, complete the threading operation with a spanner wrench. (Fig. D-22) Continue to turn the *collet tube* until it bottoms solidly with the *collet.* Gently rap the handle of the spanner wrench to assure that the *collet tube* is firmly seated.

CAUTION: The collet tube must bottom firmly on the collet shoulder. (Fig. D-23)

Loosen the *clamping screw* on the *collet tube nut* and turn the *collet tube nut* until it just touches the *finger holder thrust plate.* Lock the *collet tube nut* in this position temporarily by tightening the *clamping screw.*

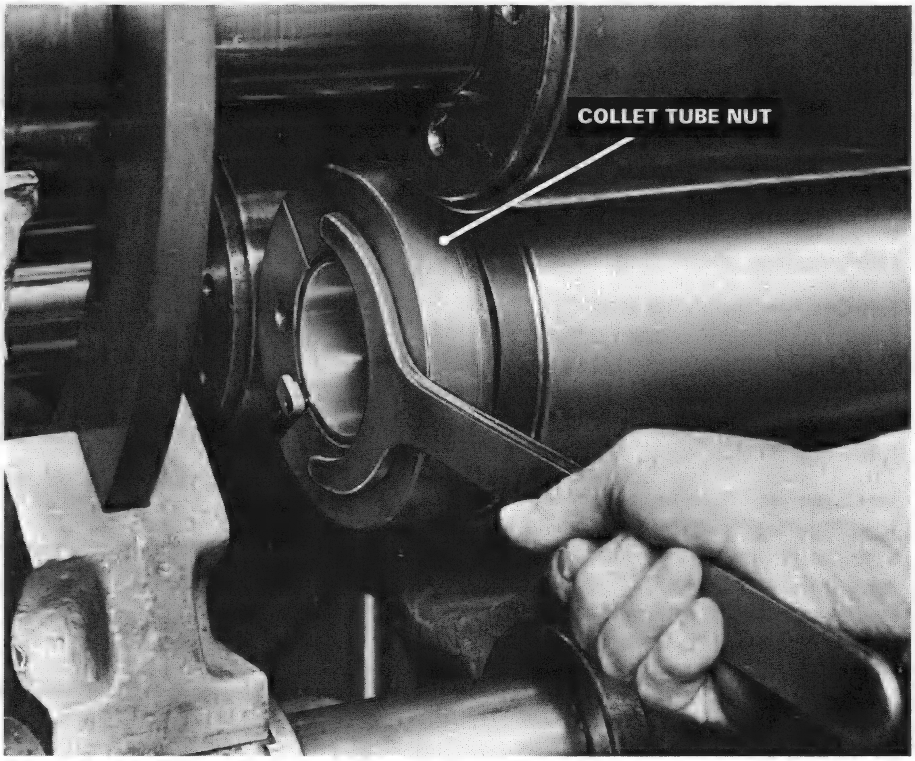

COLLET TUBE NUT

Fig. D-22. Complete threading operation with a spanner wrench.

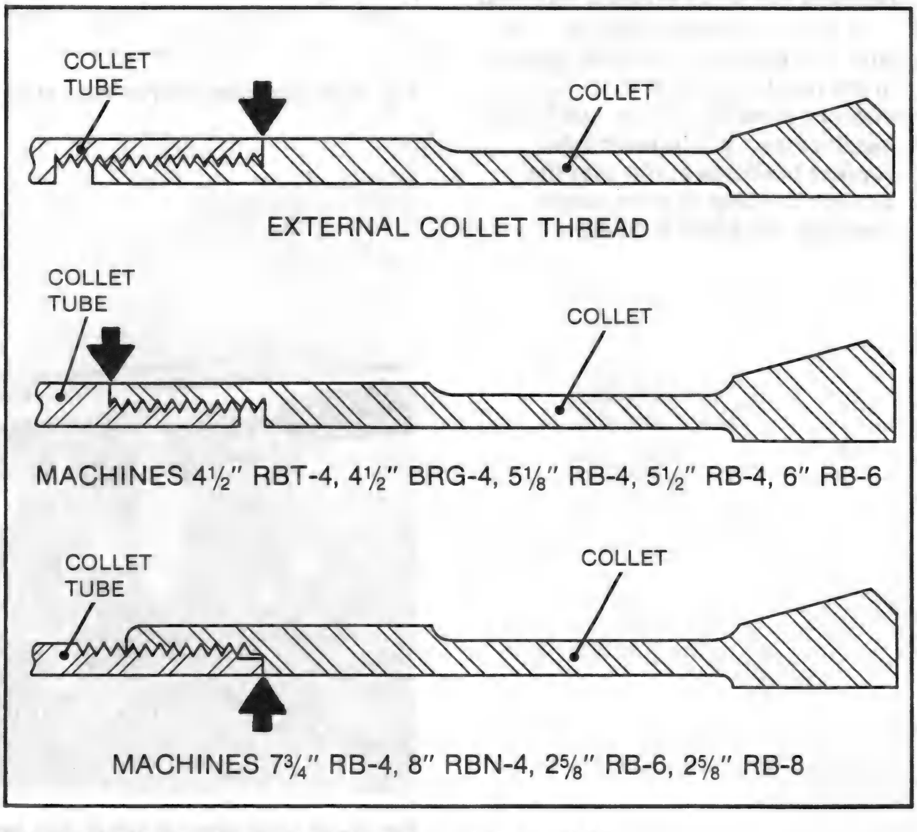

COLLET TUBE
COLLET
EXTERNAL COLLET THREAD
COLLET TUBE
COLLET
MACHINES 4½″ RBT-4, 4½″ BRG-4, 5⅛″ RB-4, 5½″ RB-4, 6″ RB-6
COLLET TUBE
COLLET
MACHINES 7¾″ RB-4, 8″ RBN-4, 2⅝″ RB-6, 2⅝″ RB-8

Fig. D-23. Collet tube must bottom on collet shoulder.

3B. Change Spool Bushing and Stock Feed Pusher

Clamp the *stock feed pusher tube* in a vise using suitable jaw pads to protect the OD of the tube. Tighten the vise firmly but do not distort the tube. Remove the *retaining ring* from the spool bushing end of tube using retaining ring pliers. (Fig. D-24)

Remove the *spool bushing.* On machine sizes 3½ inches and larger, remove the two *pusher tube support bushings* and the *support bushing spacers* located inside the pusher tube. (Fig. D-25)

Unscrew the *stock feed pusher* from the *stock feed pusher tube* using a spanner wrench (most machines have left-hand thread). (Fig. D-26) A gentle rap on the spanner wrench may be required to break the threads loose.

Clean the inside of the *stock feed pusher tube* and lubricate with a clean hand towel saturated in general purpose lubricating oil. Select the *spool bushing* specified on the Tooling Setup Chart and install. Reinstall the *spool bushing retaining ring,* using retaining ring pliers. Be sure the *retaining ring* seats securely in the *retaining ring groove.* On machine sizes 3½ inches and larger, install correct size *pusher tube support bushings* along with the *support bushing spacers* before installing the *spool bushing.*

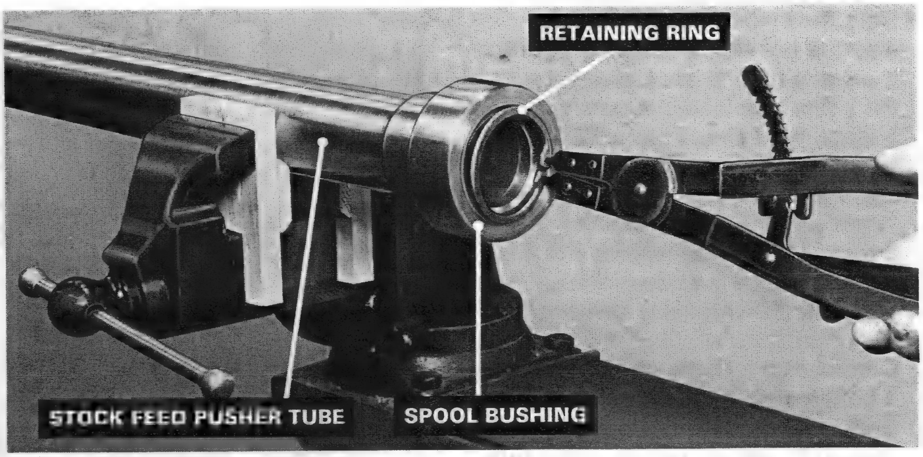

RETAINING RING
STOCK FEED PUSHER TUBE
SPOOL BUSHING

Fig. D-24. Remove spool bushing retaining ring with retaining ring pliers.

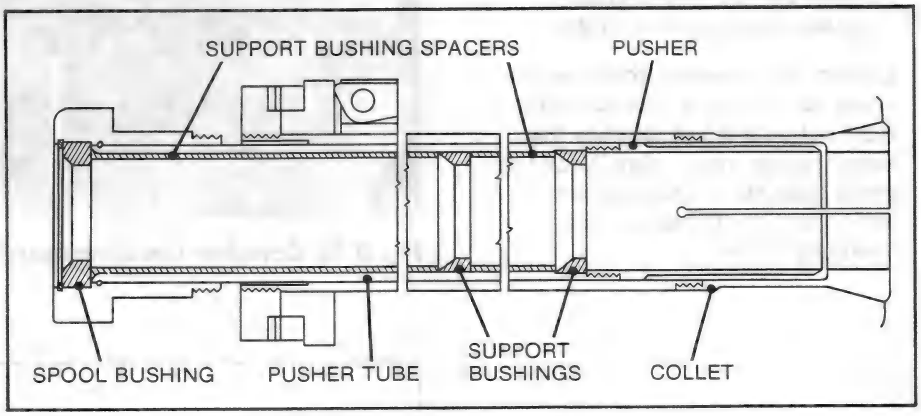

SUPPORT BUSHING SPACERS
PUSHER
SPOOL BUSHING
PUSHER TUBE
SUPPORT BUSHINGS
COLLET

Fig. D-25. Remove pusher tube support bushings and spacers.

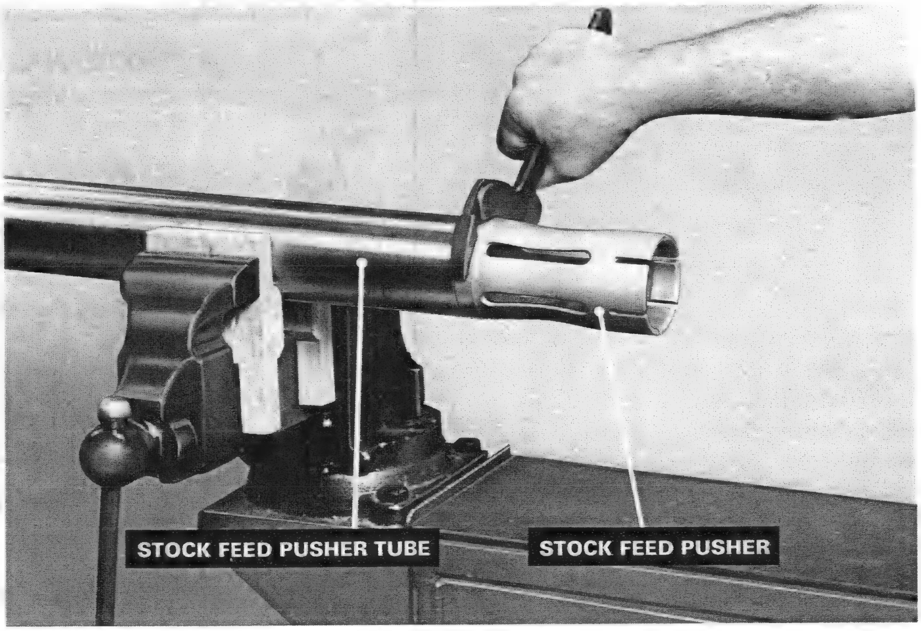

STOCK FEED PUSHER TUBE
STOCK FEED PUSHER

Fig. D-26. Use spanner wrench to unscrew stock feed pusher.

Select the *stock feed pusher* as specified on the Tooling Setup Chart. Lubricate its thread. Using a spanner wrench, screw the *pusher* into the *pusher tube* until it seats against the shoulder of the *pusher tube.* (Fig. D-27) Gently rap the handle of the spanner wrench to assure that the pusher is seated firmly.

Wipe the outside of the *pusher tube* with a clean hand towel saturated in general purpose lubricating oil.

Install the assembled *stock feed pusher tube* into the machine, sliding it gently forward until the *pusher tube spool* touches the roll on the *stock feed slide.* (Fig. D-28)

3C. Lock Pusher Tube Guard Disc

Lock the *pusher tube guard disc* by rotating it until the *guard disc locking pin* drops into its hole. Gently jiggle the *guard disc* back and forth to be sure the *guard disc locking pin* is firmly seated. (Fig. D-29)

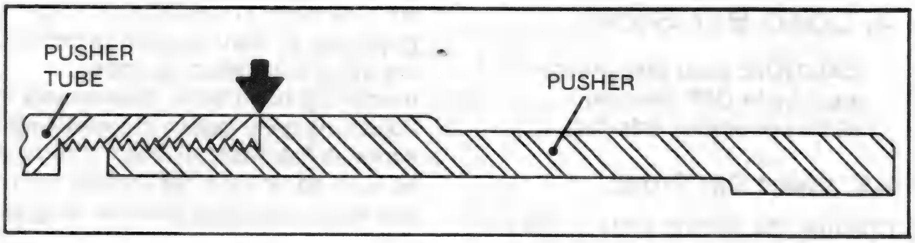


Fig. D-27. Screw pusher into pusher tube until it seats against shoulder of pusher tube.

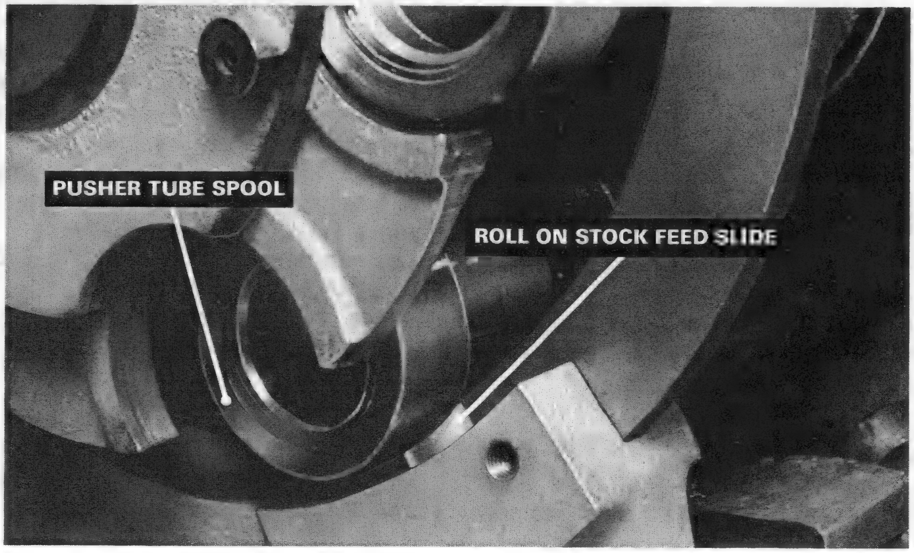


Fig. D-28. Pusher tube spool should touch roll on stock feed slide.

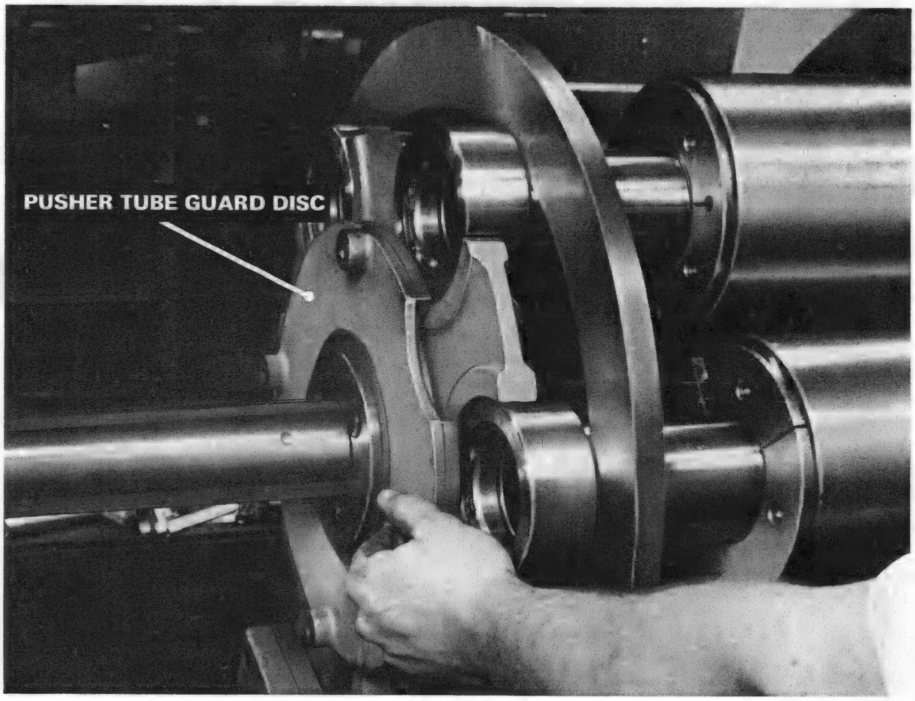


Fig. D-29. Gently jiggle the guard disc back and forth to be sure the guard disc locking pin is firmly seated.

4. Load Bar Stock

CAUTION: Main disconnect must be in OFF position while performing this step.

4A. Insert Bar Stock

Chamfer the leading edge of the bar stock to permit smooth entry of the bar into the *pusher* and *collet.*

With the *stock feed slide* fully forward (toward work spindle) and the *collet* open in the number one position, insert the bar stock from the *stock reel end.* (Fig. D-30) Push the bar stock through the *pusher tube, pusher* and *collet* until it protrudes beyond the *collet* face far enough for the *collet* to grip on the complete diameter of the bar stock. Stock on the smaller machines can normally be pushed through the *pusher* by hand. On larger machines it may be necessary to use a short bar to assist the stock thru the *pusher.*

4B. Adjust Collet Tension

Test the gripping action of the *collet* by operating the *hand chucking slide* with the *hand chucking lever.* The grip must be tight enough to prevent the stock from slipping under machining conditions. If necessary to adjust the grip, loosen the *clamping screw* in the *collet tube nut.* Check to be sure *collet tube nut locking pin* is still in the unlocked position. (Fig. D-18)

Adjust the *collet* grip by screwing the *collet tube nut* clockwise or counterclockwise with the *collet* open. The *collet tube* must not turn in the *collet* while adjusting the *collet* grip. When proper *collet* grip is reached, turn the *collet tube nut locking pin* so it lines up with the slot in the *collet tube nut.* Turn the *collet tube nut* back or forward until the *locking pin* falls into and seats in the nearest hole in the *thrust plate.* Tighten the *clamping screw* in the *collet tube nut.* (Fig. D-33)

CAUTION: Overtightening the *collet tube nut clamping screw* can collapse the *collet tube.*

Recheck the gripping action on the *collet* by manually opening and closing it several times with the *hand chucking lever.* Readjust the *collet*

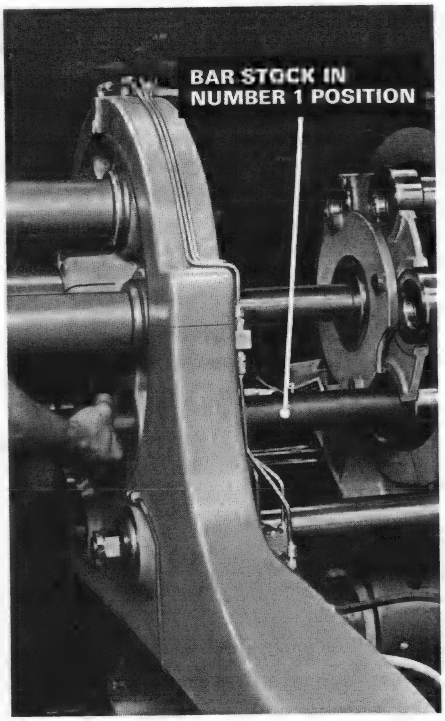


Fig. D-30. Load bar stock in number one position.

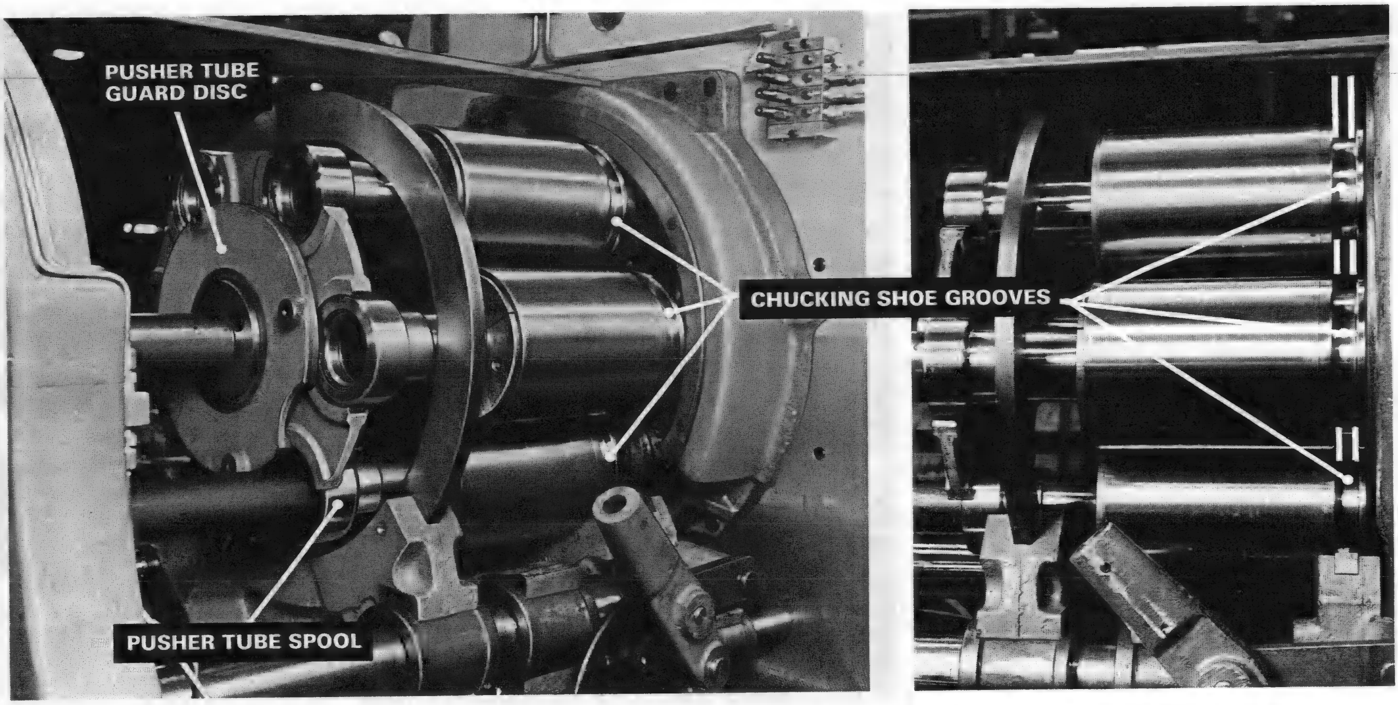


Fig. D-31. Be sure there is clearance between the end of the pusher tube spool and the pusher tube guard disc. Finger holder chucking shoe grooves must be in line.

tube nut if necessary. With the *collet* open, position the bar stock end relative to the *collet* face. The end of the bar of stock may be positioned even with the face of the *collet* or may extend out enough to set the *cutoff tool* when the bar is in the cutoff position. In some cases, the tooling determines where the bar must be positioned. Close the *collet* manually, aligning the *finger holder spool chucking shoe* groove with the one in the adjacent position. (Fig. D-31)

4C. Check Location of Pusher Tube Spool

With the *collet* closed, check to be sure that there is clearance between the end of the *pusher tube spool* and the *pusher tube guard disc.* (Fig. D-31) If necessary, provide clearance by gently tapping the *pusher tube* forward using a brass bar.

4D. Position the Stock Reel Tube

Move the *stock reel tube* forward, locking it firmly in position. (Fig. D-32)

4E. Recheck All Critical Settings

Recheck the following settings, one by one on all spindles, to be sure that:

1. *Pusher tube guard disc* is firmly locked in position. (Fig. D-29)
2. There is clearance between the *pusher tube spool* and the *guard disc.* (Fig. D-31)
3. *Collet tube nut clamping screw* is tight. (Fig. D-33)
4. *Collet tube nut locking pin* is firmly seated in position. (Fig. D-33)
5. *Collet* is closed and *finger holder spool chucking shoe* groove in the first position is in line with the *finger holder spool chucking shoe* groove in the adjacent positions. (Fig. D-31)
6. *Stock reel tube* is locked in the forward position. (Fig. D-32) Upon completion of checking these items, replace the front section of the *finger holder oil guard* before running the machine.

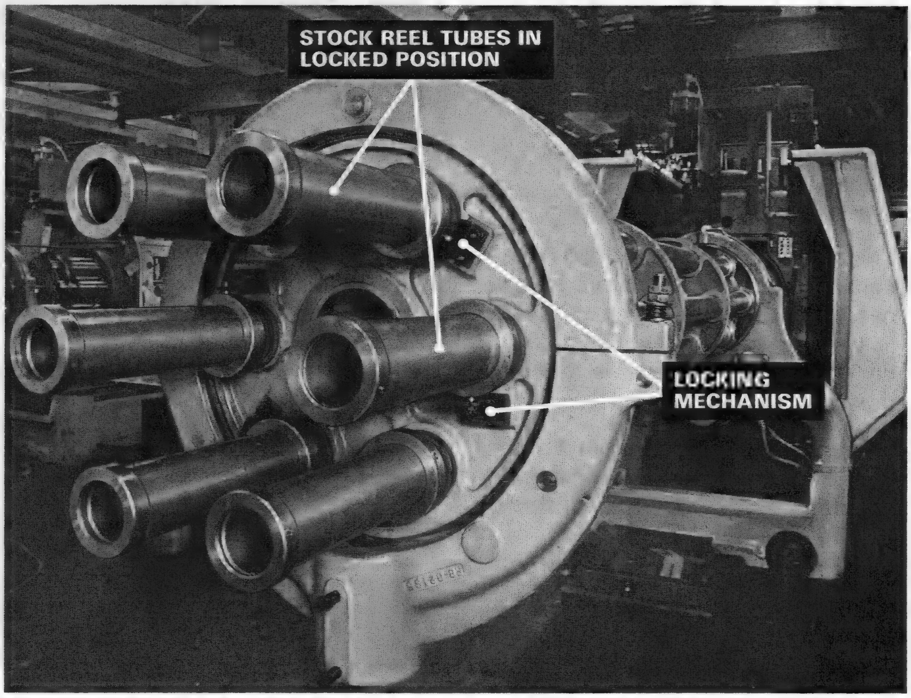


Fig. D-32. Move stock reel tube forward and lock in position.

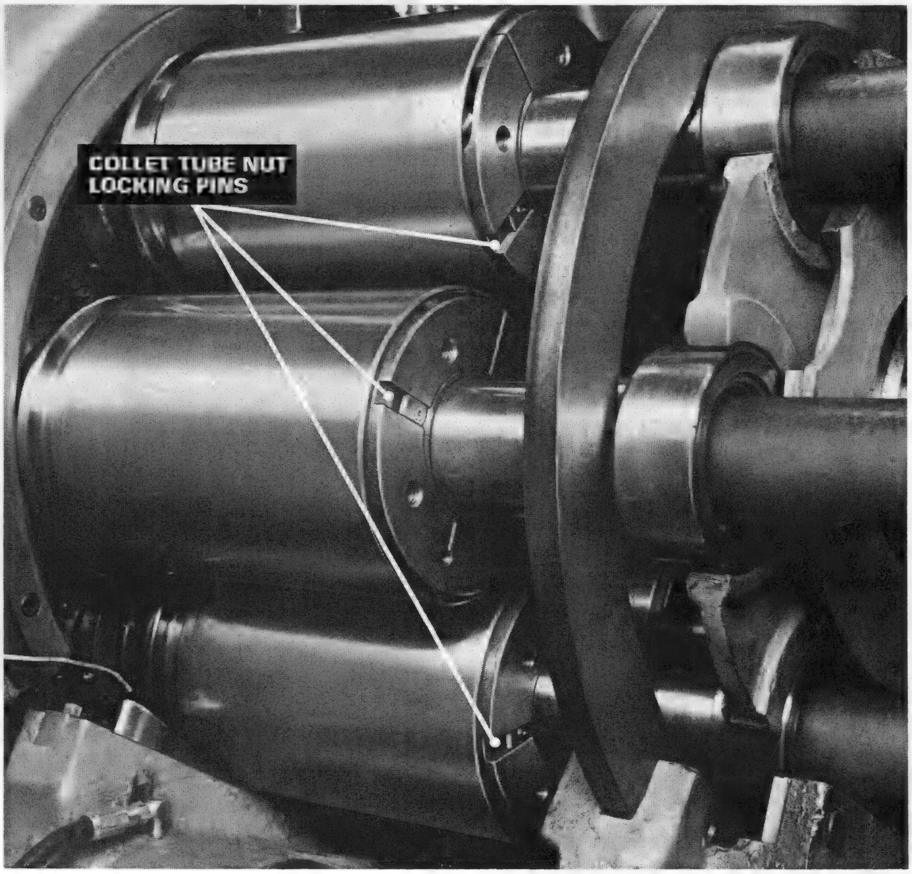


Fig. D-33. Collet tube nut locking pins firmly seated in position.

5. Change Remaining Collets, Pushers and Spool Bushings

CAUTION: Main disconnect must be in OFF position while performing this step.

The machine is now ready to have *collets, pushers* and *spool bushings* changed in the remaining *spindles.* Put main disconnect in ON position and index the next *spindle* to the first position.

Be sure to put main disconnect in OFF position before starting the work on each consecutive *spindle.* Repeat Steps 2 thru 4.

CAUTION: The spindle carrier can be indexed under power (jogging) or by the hand crank. If the machine is to be hand cranked, extreme caution should be exercised to insure that the main disconnect is in OFF position before engaging the *hand crank.* The *hand crank* must always be removed from the worm shaft when not cranking the machine and before starting the main drive motor.

6. Cancel Feeding of Bar Stock

CAUTION: Main disconnect must be in OFF position while performing this step.

NOTE: Refer to Appendix (section H, page 2) if adjustable stock feed is being used.

After all *collets* and *pushers* have been changed and adjusted, you will proceed with the setup, but you will **not** want the bar stock to be fed into the tooling area after each index.

6A. Block Stock Feed Slide

Fasten stop block in front of the *stock feed slide* when the *stock feed slide roll* is at the high point of the *stock feed cam.* (Fig. D-34) The length of this block should be the same as the distance between the front of the *stock feed slide* and the adjacent *collar.*

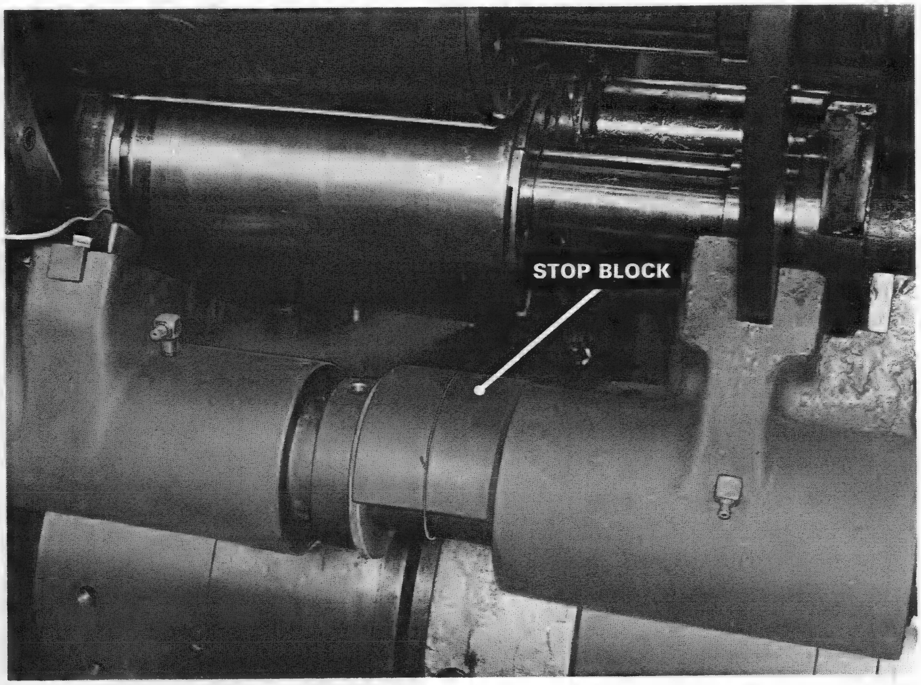


Fig. D-34. Use stop block to cancel feeding of bar stock.

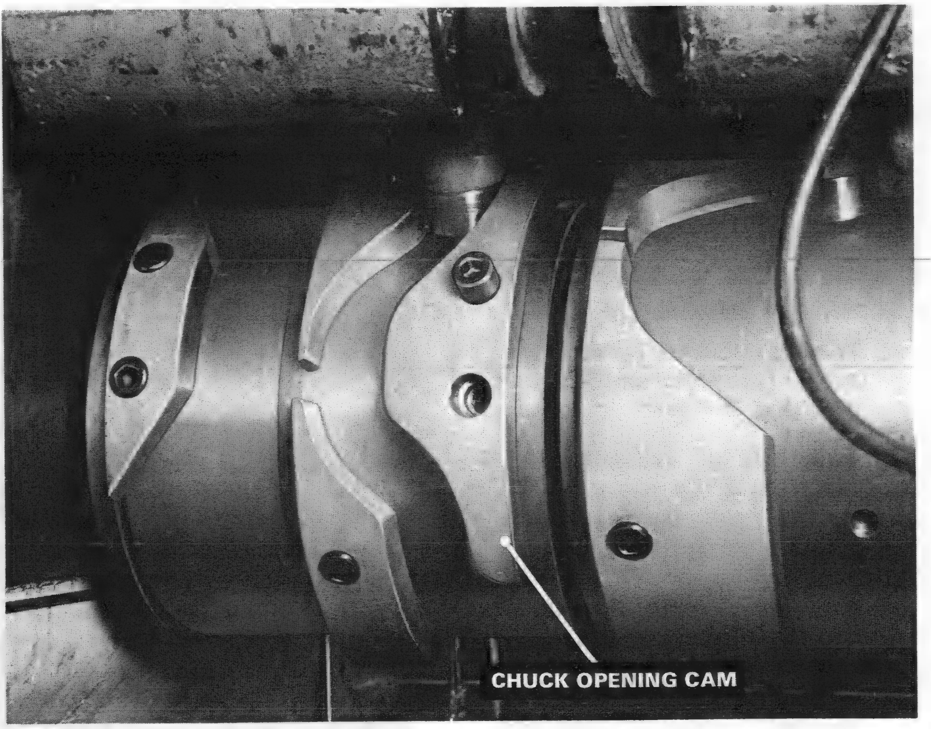


Fig. D-35. Remove chuck opening cam to cancel feeding of bar stock.

6B. Remove Chuck Opening Cam

Remove the *chuck opening cam* so *collets* will remain closed, keeping stock from feeding out into the tooling area. (Fig. D-35)

7. Change Spindle Speed and Feed Gears

CAUTION: Main disconnect must be in OFF position while performing this step.

The *spindle gears* consist of a set of two *spindle speed change gears* and a set of *spindle speed range gears* for low or high speed range. The *feed gears* consist of a set of two *feed change gears* and a set of *feed range gears* for fine or coarse feed. In both cases the *change gears* are changed by removing and replacing the gears. The *range gears* are changed by repositioning gears in the *gearbox.*

These spindle speed and feed gears are designated on the Tooling Setup Chart as shown in Fig. D-36. On the "Spindle Gears" line, the first number (36) indicates the number of teeth on the *drive* change gear and the second number (68) indicates the number of teeth on the *driven* change gear. On the "Feed Gears" line, the first number (42) indicates the number of teeth on the *drive* feed gear and the second number (62) indicates the number of teeth on the *driven* feed gear. The words "low" or "high" indicate the position of the *spindle speed range gears.* The words "fine" or "coarse" indicate the position of the *feed range gears.*

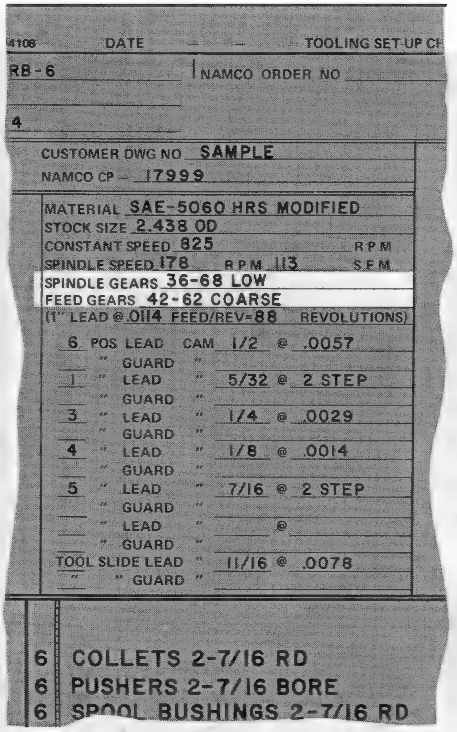
The *change gears* can be located in any of three different places depending on the machine model. The following setup steps refer to a machine where the *spindle speed change gears* and *feed change gears* are located at the motor end. For other models, refer to Appendix section H, page 5.

7A. Replace Change Gears

Remove the split nuts from the ends of the three shafts. Remove the four *change gears.* (Fig. D-37)

Place the *spindle speed change drive gear* (36 teeth in example) on the right-hand shaft and replace the *split nut.*

Place the *spindle speed change driven gear* (68 teeth in example) on the middle shaft. Next place the *feed change drive gear* (42 teeth in example) on the same middle shaft and replace the *split nut.*



4108 DATE — — TOOLING SET-UP CH

RB-6 | NAMCO ORDER NO

4

CUSTOMER DWG NO SAMPLE
NAMCO CP – 17999

MATERIAL SAE-5060 HRS MODIFIED
STOCK SIZE 2.438 OD
CONSTANT SPEED 825 RPM
SPINDLE SPEED 178 RPM 113 SFM
SPINDLE GEARS 36-68 LOW
FEED GEARS 42-62 COARSE
(1" LEAD @ .0114 FEED/REV=88 REVOLUTIONS)

6 POS LEAD CAM 1/2 @ .0057
" GUARD "
1 " LEAD " 5/32 @ 2 STEP
" GUARD "
3 " LEAD " 1/4 @ .0029
" GUARD "
4 " LEAD " 1/8 @ .0014
" GUARD "
5 " LEAD " 7/16 @ 2 STEP
" GUARD "
" LEAD " @
" GUARD "
TOOL SLIDE LEAD " 11/16 @ .0078
" " GUARD "

6 COLLETS 2-7/16 RD
6 PUSHERS 2-7/16 BORE
6 SPOOL BUSHINGS 2-7/16 RD

Fig. D-36. Spindle speed and feed gear designations on Tooling Setup Chart.

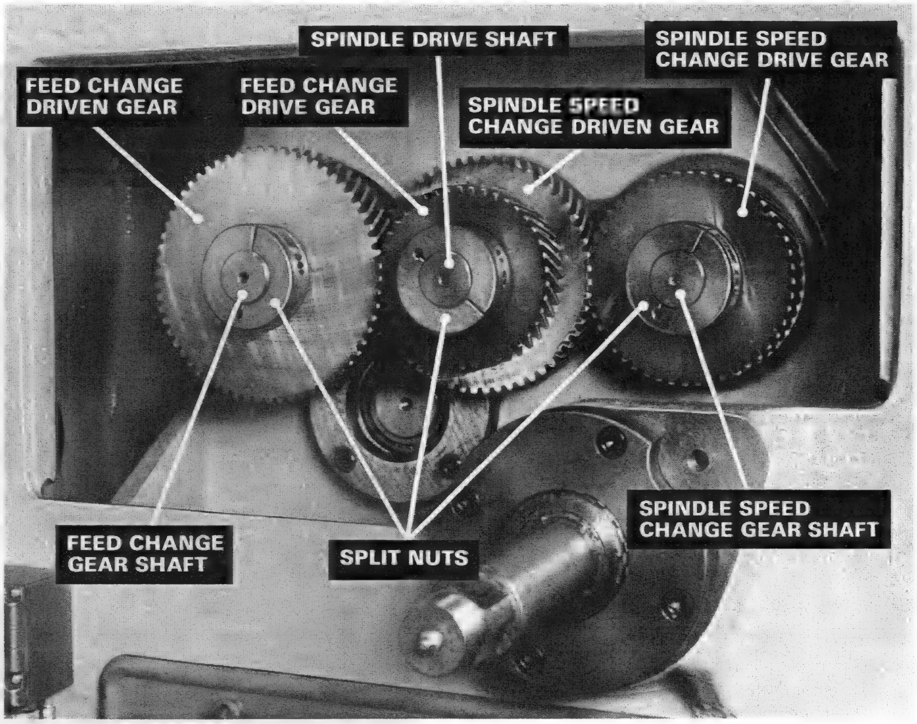


Fig. D-37. Replace change gears.

Place the *feed change driven gear* (62 teeth in example) on the left-hand shaft and replace the *split nut*.

> **CAUTION: A clearance of approximately 1/32 inch is required between gears wherever they overlap. (Fig. D-38)**

7B. Reposition Range Gears

The *spindle speed range gears* are located in the gearbox on the rear side of the machine. (Fig. D-39) If the gears need to be repositioned, remove the *split collar* and move the set of *spindle speed range gears* to the alternate position. Replace the *split collar* on the other side of the gear set to keep it in its new position.

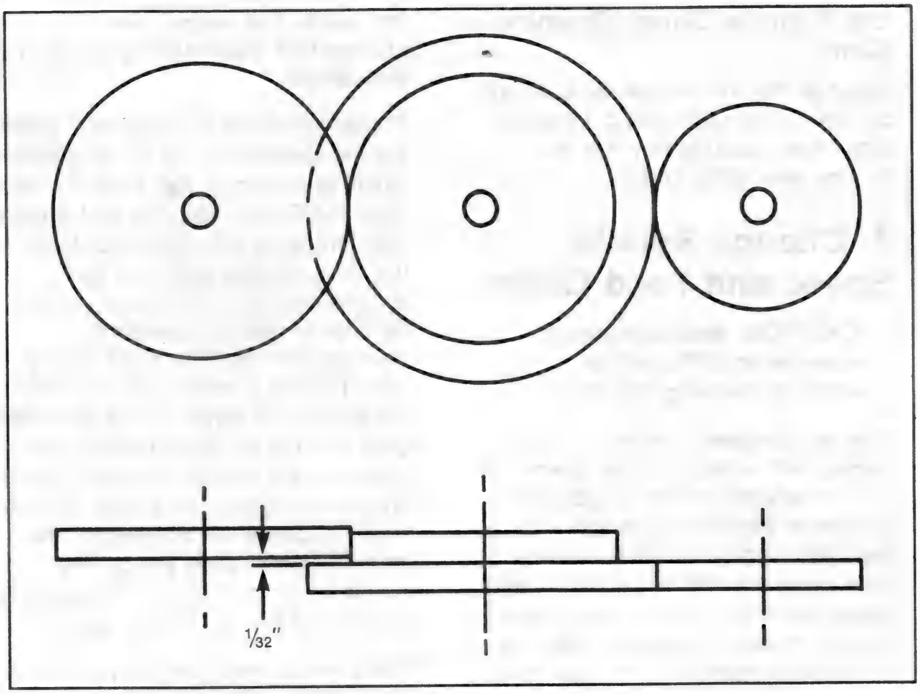


Fig. D-38. Gears require clearance where they overlap.

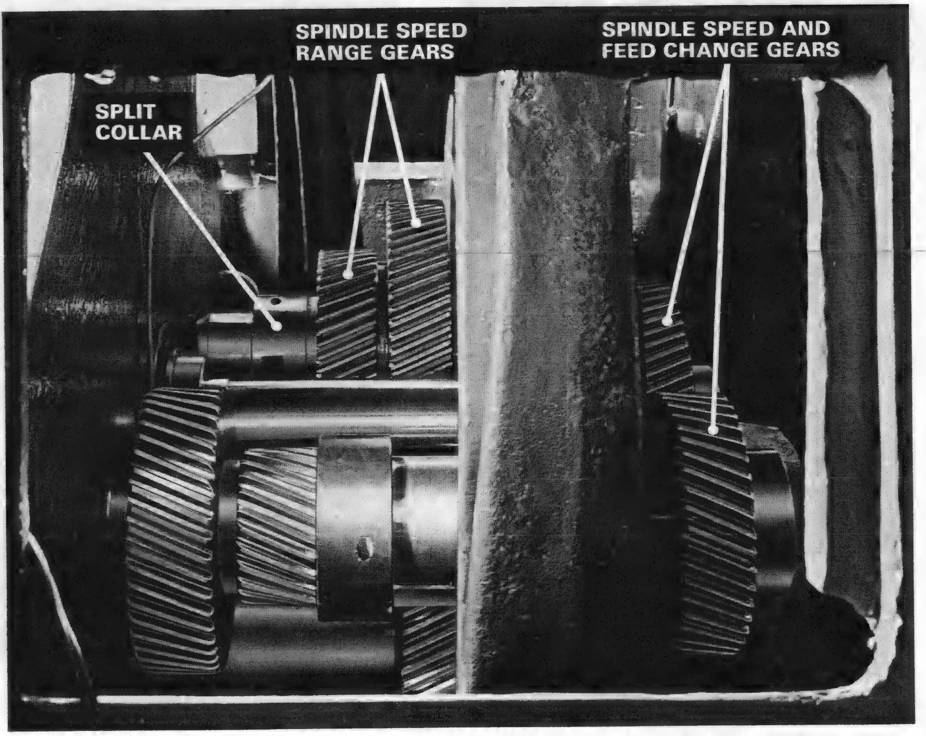

SPINDLE SPEED RANGE GEARS
SPINDLE SPEED AND FEED CHANGE GEARS
SPLIT COLLAR

Fig. D-39. Spindle speed range gears (viewed from front — first position — side of machine).

The *feed range gears* are located in the gearbox on the front side of the machine. (Fig. D-40) They are repositioned in the same manner as the *spindle speed range gears.*

The high or low speed range and the coarse or fine feed range are obtained by positioning the gears as specified on the machine's Gear Chart. (Fig. D-41)

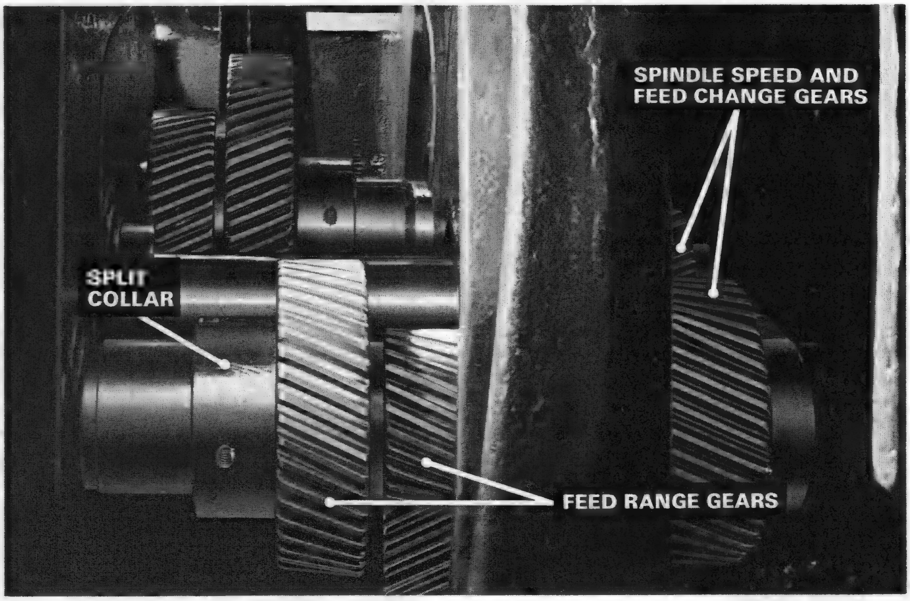
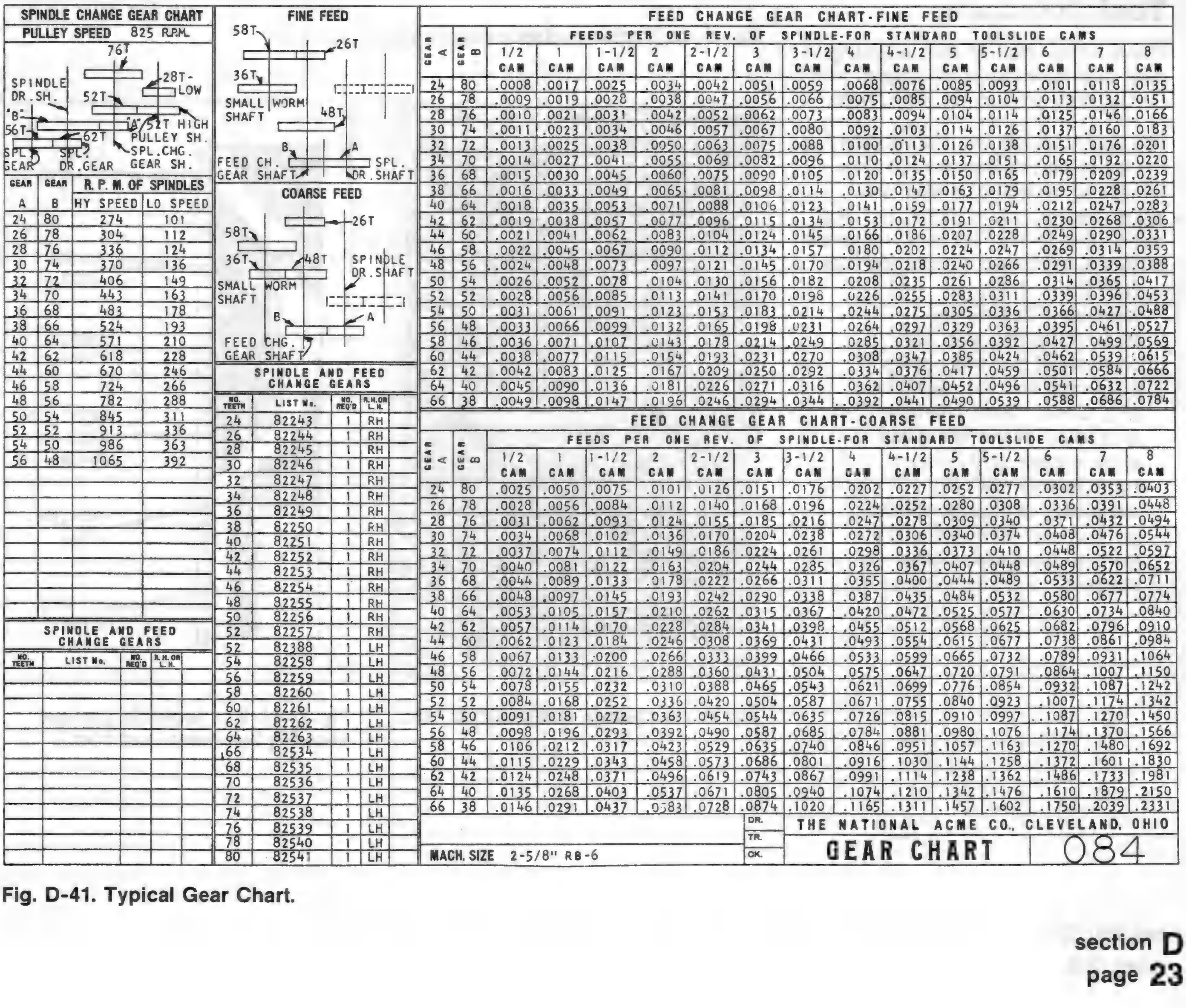


Fig. D-40. Feed range gears (viewed from front — first position — side of machine).


76T
SPINDLE DR. SH.
28T-LOW
52T
"B"
56T
"A" 52T HIGH
62T
PULLEY SH.
SPL. CHG. GEAR SH.
SPL. GEAR
SPL. DR. GEAR
FINE FEED
58T
26T
36T
SMALL WORM SHAFT
48T
B
A
FEED CH. GEAR SHAFT
SPL. DR. SHAFT
COARSE FEED
26T
58T
36T
48T
SPINDLE DR. SHAFT
SMALL WORM SHAFT
B
A
FEED CHG. GEAR SHAFT

SPINDLE CHANGE GEAR CHART

PULLEY SPEED 825 R.P.M.

GEAR A	GEAR B	R. P. M. OF SPINDLES HY SPEED	R. P. M. OF SPINDLES LO SPEED
24	80	274	101
26	78	304	112
28	76	336	124
30	74	370	136
32	72	406	149
34	70	443	163
36	68	483	178
38	66	524	193
40	64	571	210
42	62	618	228
44	60	670	246
46	58	724	266
48	56	782	288
50	54	845	311
52	52	913	336
54	50	986	363
56	48	1065	392

SPINDLE AND FEED CHANGE GEARS

NO. TEETH	LIST No.	NO. REQ'D	R. H. OR L. H.

SPINDLE AND FEED CHANGE GEARS

NO. TEETH	LIST No.	NO. REQ'D	R. H. OR L. H.
24	82243	1	RH
26	82244	1	RH
28	82245	1	RH
30	82246	1	RH
32	82247	1	RH
34	82248	1	RH
36	82249	1	RH
38	82250	1	RH
40	82251	1	RH
42	82252	1	RH
44	82253	1	RH
46	82254	1	RH
48	82255	1	RH
50	82256	1	RH
52	82257	1	RH
52	82388	1	LH
54	82258	1	LH
56	82259	1	LH
58	82260	1	LH
60	82261	1	LH
62	82262	1	LH
64	82263	1	LH
66	82534	1	LH
68	82535	1	LH
70	82536	1	LH
72	82537	1	LH
74	82538	1	LH
76	82539	1	LH
78	82540	1	LH
80	82541	1	LH

FEED CHANGE GEAR CHART-FINE FEED

GEAR A	GEAR B	FEEDS PER ONE REV. OF SPINDLE-FOR STANDARD TOOLSLIDE CAMS 1/2 CAM	1 CAM	1-1/2 CAM	2 CAM	2-1/2 CAM	3 CAM	3-1/2 CAM	4 CAM	4-1/2 CAM	5 CAM	5-1/2 CAM	6 CAM	7 CAM	8 CAM
24	80	.0008	.0017	.0025	.0034	.0042	.0051	.0059	.0068	.0076	.0085	.0093	.0101	.0118	.0135
26	78	.0009	.0019	.0028	.0038	.0047	.0056	.0066	.0075	.0085	.0094	.0104	.0113	.0132	.0151
28	76	.0010	.0021	.0031	.0042	.0052	.0062	.0073	.0083	.0094	.0104	.0114	.0125	.0146	.0166
30	74	.0011	.0023	.0034	.0046	.0057	.0067	.0080	.0092	.0103	.0114	.0126	.0137	.0160	.0183
32	72	.0013	.0025	.0038	.0050	.0063	.0075	.0088	.0100	.0113	.0126	.0138	.0151	.0176	.0201
34	70	.0014	.0027	.0041	.0055	.0069	.0082	.0096	.0110	.0124	.0137	.0151	.0165	.0192	.0220
36	68	.0015	.0030	.0045	.0060	.0075	.0090	.0105	.0120	.0135	.0150	.0165	.0179	.0209	.0239
38	66	.0016	.0033	.0049	.0065	.0081	.0098	.0114	.0130	.0147	.0163	.0179	.0195	.0228	.0261
40	64	.0018	.0035	.0053	.0071	.0088	.0106	.0123	.0141	.0159	.0177	.0194	.0212	.0247	.0283
42	62	.0019	.0038	.0057	.0077	.0096	.0115	.0134	.0153	.0172	.0191	.0211	.0230	.0268	.0306
44	60	.0021	.0041	.0062	.0083	.0104	.0124	.0145	.0166	.0186	.0207	.0228	.0249	.0290	.0331
46	58	.0022	.0045	.0067	.0090	.0112	.0134	.0157	.0180	.0202	.0224	.0247	.0269	.0314	.0359
48	56	.0024	.0048	.0073	.0097	.0121	.0145	.0170	.0194	.0218	.0240	.0266	.0291	.0339	.0388
50	54	.0026	.0052	.0078	.0104	.0130	.0156	.0182	.0208	.0235	.0261	.0286	.0314	.0365	.0417
52	52	.0028	.0056	.0085	.0113	.0141	.0170	.0198	.0226	.0255	.0283	.0311	.0339	.0396	.0453
54	50	.0031	.0061	.0091	.0123	.0153	.0183	.0214	.0244	.0275	.0305	.0336	.0366	.0427	.0488
56	48	.0033	.0066	.0099	.0132	.0165	.0198	.0231	.0264	.0297	.0329	.0363	.0395	.0461	.0527
58	46	.0036	.0071	.0107	.0143	.0178	.0214	.0249	.0285	.0321	.0356	.0392	.0427	.0499	.0569
60	44	.0038	.0077	.0115	.0154	.0193	.0231	.0270	.0308	.0347	.0385	.0424	.0462	.0539	.0615
62	42	.0042	.0083	.0125	.0167	.0209	.0250	.0292	.0334	.0376	.0417	.0459	.0501	.0584	.0666
64	40	.0045	.0090	.0136	.0181	.0226	.0271	.0316	.0362	.0407	.0452	.0496	.0541	.0632	.0722
66	38	.0049	.0098	.0147	.0196	.0246	.0294	.0344	.0392	.0441	.0490	.0539	.0588	.0686	.0784

FEED CHANGE GEAR CHART-COARSE FEED

GEAR A	GEAR B	FEEDS PER ONE REV. OF SPINDLE-FOR STANDARD TOOLSLIDE CAMS 1/2 CAM	1 CAM	1-1/2 CAM	2 CAM	2-1/2 CAM	3 CAM	3-1/2 CAM	4 CAM	4-1/2 CAM	5 CAM	5-1/2 CAM	6 CAM	7 CAM	8 CAM
24	80	.0025	.0050	.0075	.0101	.0126	.0151	.0176	.0202	.0227	.0252	.0277	.0302	.0353	.0403
26	78	.0028	.0056	.0084	.0112	.0140	.0168	.0196	.0224	.0252	.0280	.0308	.0336	.0391	.0448
28	76	.0031	.0062	.0093	.0124	.0155	.0185	.0216	.0247	.0278	.0309	.0340	.0371	.0432	.0494
30	74	.0034	.0068	.0102	.0136	.0170	.0204	.0238	.0272	.0306	.0340	.0374	.0408	.0476	.0544
32	72	.0037	.0074	.0112	.0149	.0186	.0224	.0261	.0298	.0336	.0373	.0410	.0448	.0522	.0597
34	70	.0040	.0081	.0122	.0163	.0204	.0244	.0285	.0326	.0367	.0407	.0448	.0489	.0570	.0652
36	68	.0044	.0089	.0133	.0178	.0222	.0266	.0311	.0355	.0400	.0444	.0489	.0533	.0622	.0711
38	66	.0048	.0097	.0145	.0193	.0242	.0290	.0338	.0387	.0435	.0484	.0532	.0580	.0677	.0774
40	64	.0053	.0105	.0157	.0210	.0262	.0315	.0367	.0420	.0472	.0525	.0577	.0630	.0734	.0840
42	62	.0057	.0114	.0170	.0228	.0284	.0341	.0398	.0455	.0512	.0568	.0625	.0682	.0796	.0910
44	60	.0062	.0123	.0184	.0246	.0308	.0369	.0431	.0493	.0554	.0615	.0677	.0738	.0861	.0984
46	58	.0067	.0133	.0200	.0266	.0333	.0399	.0466	.0533	.0599	.0665	.0732	.0789	.0931	.1064
48	56	.0072	.0144	.0216	.0288	.0360	.0431	.0504	.0575	.0647	.0720	.0791	.0864	.1007	.1150
50	54	.0078	.0155	.0232	.0310	.0388	.0465	.0543	.0621	.0699	.0776	.0854	.0932	.1087	.1242
52	52	.0084	.0168	.0252	.0336	.0420	.0504	.0587	.0671	.0755	.0840	.0923	.1007	.1174	.1342
54	50	.0091	.0181	.0272	.0363	.0454	.0544	.0635	.0726	.0815	.0910	.0997	.1087	.1270	.1450
56	48	.0098	.0196	.0293	.0392	.0490	.0587	.0685	.0784	.0881	.0980	.1076	.1174	.1370	.1566
58	46	.0106	.0212	.0317	.0423	.0529	.0635	.0740	.0846	.0951	.1057	.1163	.1270	.1480	.1692
60	44	.0115	.0229	.0343	.0458	.0573	.0686	.0801	.0916	.1030	.1144	.1258	.1372	.1601	.1830
62	42	.0124	.0248	.0371	.0496	.0619	.0743	.0867	.0991	.1114	.1238	.1362	.1486	.1733	.1981
64	40	.0135	.0268	.0403	.0537	.0671	.0805	.0940	.1074	.1210	.1342	.1476	.1610	.1879	.2150
66	38	.0146	.0291	.0437	.0583	.0728	.0874	.1020	.1165	.1311	.1457	.1602	.1750	.2039	.2331

DR.
TR.
CK.

MACH. SIZE 2-5/8" RB-6

THE NATIONAL ACME CO., CLEVELAND, OHIO

GEAR CHART 084

Fig. D-41. Typical Gear Chart.

CAUTION: Steps 8 thru 10 are *cam* changing procedures. The labor and time required can be greatly reduced by the careful use of the JOG mode. After JOG mode is used, be certain that the main disconnect is in the OFF position before proceeding. However, if the machine must be cranked, extreme caution should be exercised to insure that the main disconnect is in OFF position before engaging the *hand crank. Hand crank* must always be removed from the worm shaft when not cranking the machine and before starting the main drive motor.

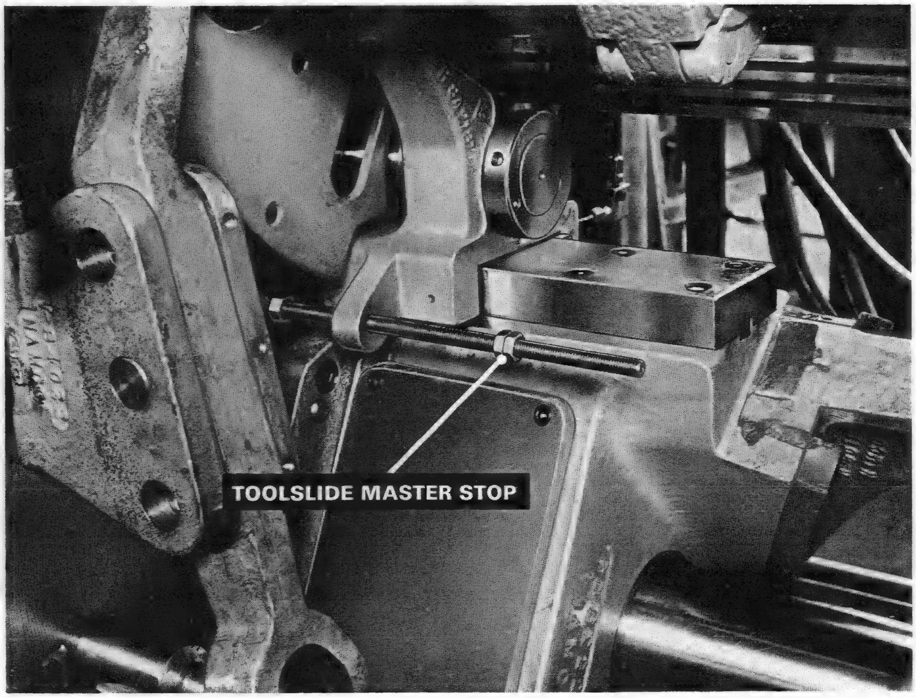


Fig. D-42. Typical toolslide master stop.

8. Change End Toolslide Cam

The *toolslide master stop adjusting nuts* must be backed off before starting this procedure. (Fig. D-42)

The *end toolslide cams* are located in the lower part of the *gearbox* (Fig. D-43) and consist of a *lead, lead guard, return, return guard* and *filler cams.* (Fig. D-44) The *lead* and *guard cams* are furnished in matched sets.

NOTE: On the larger machines, to simplify installation, the *lead cam* consists of two pieces, the *base cam* and the *lead cam.* (Fig. D-44) When changing *lead cams* of the two-piece style, a *base cam* is not furnished as it is only necessary to change the *lead* portion. For *lead* limitations on two-piece style *cams,* see Appendix, section H, page 10.

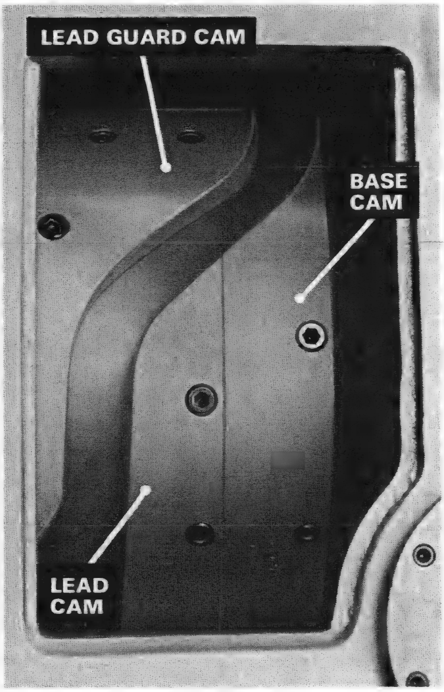


Fig. D-43. Change end toolslide cam.

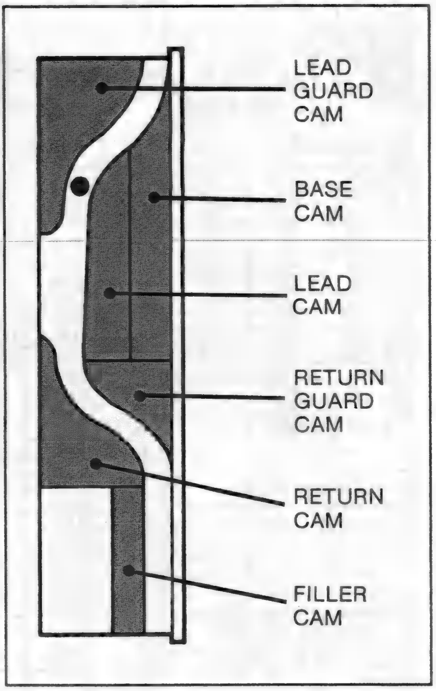


Fig. D-44. End toolslide cam set showing two-piece lead cam.

The lead of the *end toolslide lead cam* required is specified on the Tooling Setup Chart #75 as shown in Fig. D-45. The *return, return guard* and *filler cams* are not changed except to change the total travel of the *end toolslide.*

Remove the *lead* and *lead guard cam* set. Clean the drum carefully. Install the required *lead* and *lead guard cam* set with the *lead cam* placed firmly against the flange or base cam.

> IMPORTANT: After the cams are securely installed, check the complete cam track, using a plug of the same diameter as the cam roll, to assure that it can pass freely between the cams.

9. Set Toolslide Master Stop

At this time, set main disconnect to ON position (be sure *hand crank* is removed).

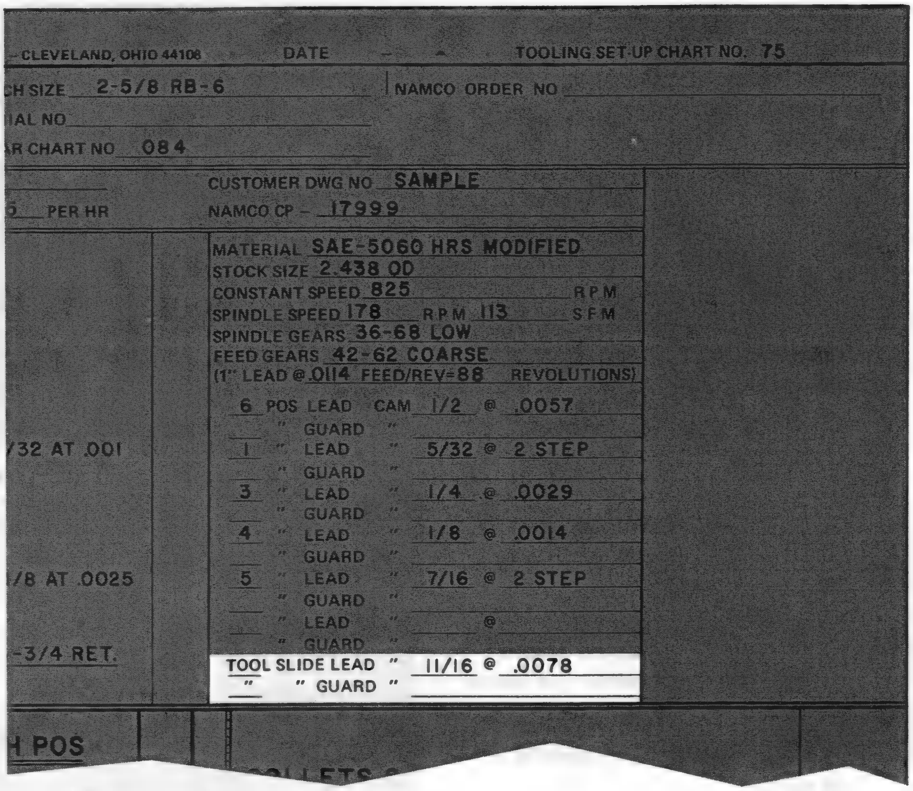
> **CAUTION: *Hand crank* must always be removed from the worm shaft when not cranking the machine and before starting the main drive motor.**

Jog the machine to rotate the *end toolslide cam drum* until the *end toolslide cam follower roll* is on the high point of the *end toolslide cam.*

> **CAUTION: Set main disconnect to OFF position before performing the remainder of this step.**

Adjust the *toolslide master stop adjusting nuts* to hold the slide back 0.005 to 0.007 inch on machines smaller than 1⅝" and 0.010 to 0.012 inch on larger machines. (Fig. D-46)

> **CAUTION: If hand crank is used, be sure main disconnect is in OFF position before hand crank is engaged. Be sure to remove hand crank as soon as the end toolslide cam drum is in position. Hand crank must always be removed from the worm shaft when not cranking the machine and before starting the main drive motor.**



CLEVELAND, OHIO 44108 DATE TOOLING SET-UP CHART NO. 75

CH SIZE 2-5/8 RB-6 NAMCO ORDER NO

IAL NO

R CHART NO 084

CUSTOMER DWG NO SAMPLE

5 PER HR NAMCO CP – 17999

MATERIAL SAE-5060 HRS MODIFIED

STOCK SIZE 2.438 OD

CONSTANT SPEED 825 R P M

SPINDLE SPEED 178 R P M 113 S F M

SPINDLE GEARS 36-68 LOW

FEED GEARS 42-62 COARSE

(1" LEAD @ .0114 FEED/REV=88 REVOLUTIONS)

6 POS LEAD CAM 1/2 @ .0057

" GUARD "

/32 AT .001 1 " LEAD " 5/32 @ 2 STEP

" GUARD "

3 " LEAD " 1/4 @ .0029

" GUARD "

4 " LEAD " 1/8 @ .0014

" GUARD "

/8 AT .0025 5 " LEAD " 7/16 @ 2 STEP

" GUARD "

" LEAD " @

" GUARD "

-3/4 RET. TOOL SLIDE LEAD " 11/16 @ .0078

" " GUARD "

H POS

Fig. D-45. Lead of end toolslide lead cam is specified on the Tooling Setup Chart.

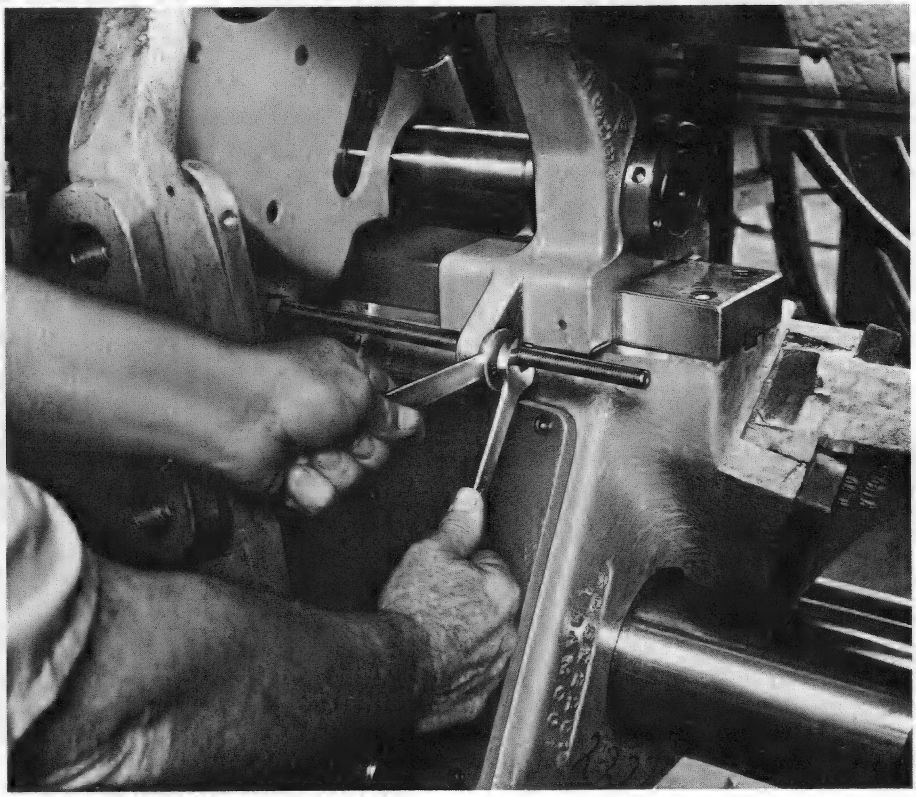


Fig. D-46. Set toolslide master stop.

10. Change Cross Slide Cams

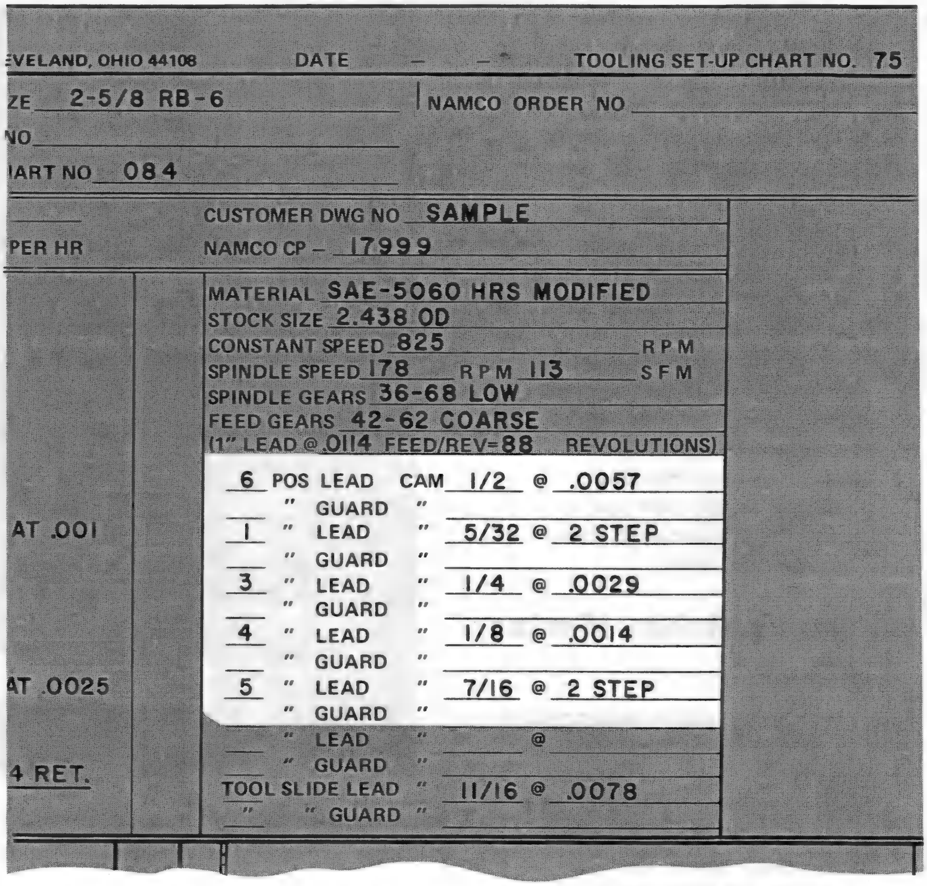
The leads of the *cross slide cams* required are specified on the Tooling Setup Chart #75 as shown in Fig. D-47.

General Instructions

1. Caution should be used when removing and replacing cams to prevent injury from possible pinch points.
2. Lead cams must be placed firmly against the flange of the drum when being installed and bolted in place firmly.
3. After cams are securely installed, check the complete cam track using a plug of the same diameter as the cam roll to assure that it can pass freely between the cams.
4. Apply a generous amount of grease to the working surface of the cams.

10A. Change Lower Cross Slide Cams

Loosen the *binder screw* and back off the *cross slide stop screw* of both *lower cross slides* before starting this procedure. (Fig. D-48)



EVELAND, OHIO 44108 DATE – – TOOLING SET-UP CHART NO. 75

ZE 2-5/8 RB-6 | NAMCO ORDER NO

NO

ART NO 084

CUSTOMER DWG NO SAMPLE

PER HR NAMCO CP – 17999

MATERIAL SAE-5060 HRS MODIFIED
STOCK SIZE 2.438 OD
CONSTANT SPEED 825 RPM
SPINDLE SPEED 178 RPM 113 SFM
SPINDLE GEARS 36-68 LOW
FEED GEARS 42-62 COARSE
(1" LEAD @ .0114 FEED/REV=88 REVOLUTIONS)

6 POS LEAD CAM 1/2 @ .0057
" GUARD "
AT .001 1 " LEAD " 5/32 @ 2 STEP
" GUARD "
3 " LEAD " 1/4 @ .0029
" GUARD "
4 " LEAD " 1/8 @ .0014
" GUARD "
AT .0025 5 " LEAD " 7/16 @ 2 STEP
" GUARD "
" LEAD " @
" GUARD "
4 RET. TOOL SLIDE LEAD " 11/16 @ .0078
" " GUARD "

Fig. D-47. Leads of the cross slide cams are specified on the Tooling Setup Chart.

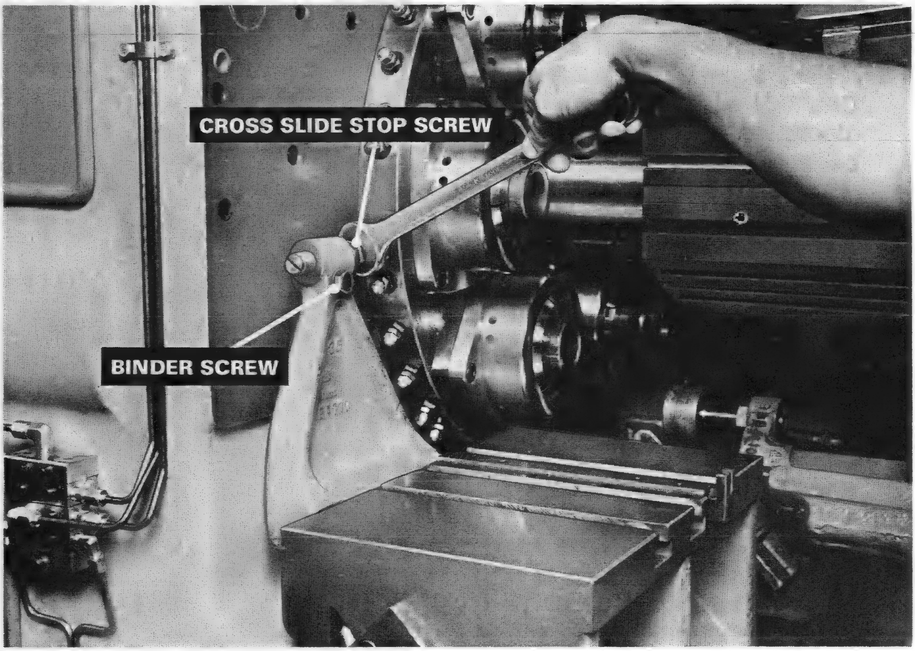


Fig. D-48. Back off lower cross slide stop screw (only lower front cross slide shown).

Machines Equipped with Single Cam Drum (most RB machines)

Remove the *support cover* on end of cross slide housing. Crank or jog machine to rotate the *lower cross slide cam drum* until identification marks (prick punch marks) on drum align with identification marks on housing. (Fig. D-49) Remove the *split nut* on the end of the shaft. Screw on the *pilot extension shaft.* Pull the drum out onto the *pilot extension shaft.* (Fig. D-50) **Remove the *lead guard cam* first and then the *lead cam*.**

Clean the drum carefully. Install the *lead* and *lead guard cams* specified on the Tooling Setup Chart (Fig. D-47) in the same position as the removed cams.

> NOTE: Install the *lead cam* first.
>
> IMPORTANT: After the cams are securely installed, check the complete cam track, using a plug of the same diameter as the cam roll, to assure that it can pass freely between the cams.

Apply a generous amount of grease to the working surfaces of the cams.

Orient the one spline notch of the drum that has a high cutout with the one spline of the drum shaft that is fitted with a roll pin. Slide the drum back into its operating position and remove the *pilot extension shaft.* Replace the *split nut* and *support cover.*

Repeat this procedure with the *lower cross slide cams* on the opposite side of machine.

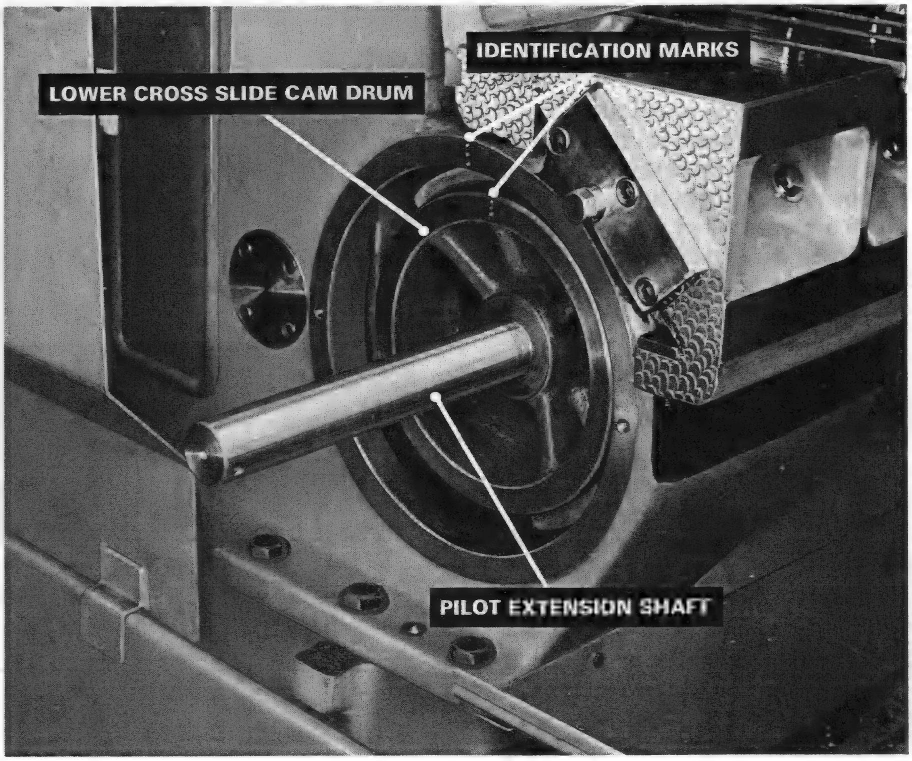


Fig. D-49. Match up identification marks and screw on pilot extension shaft.

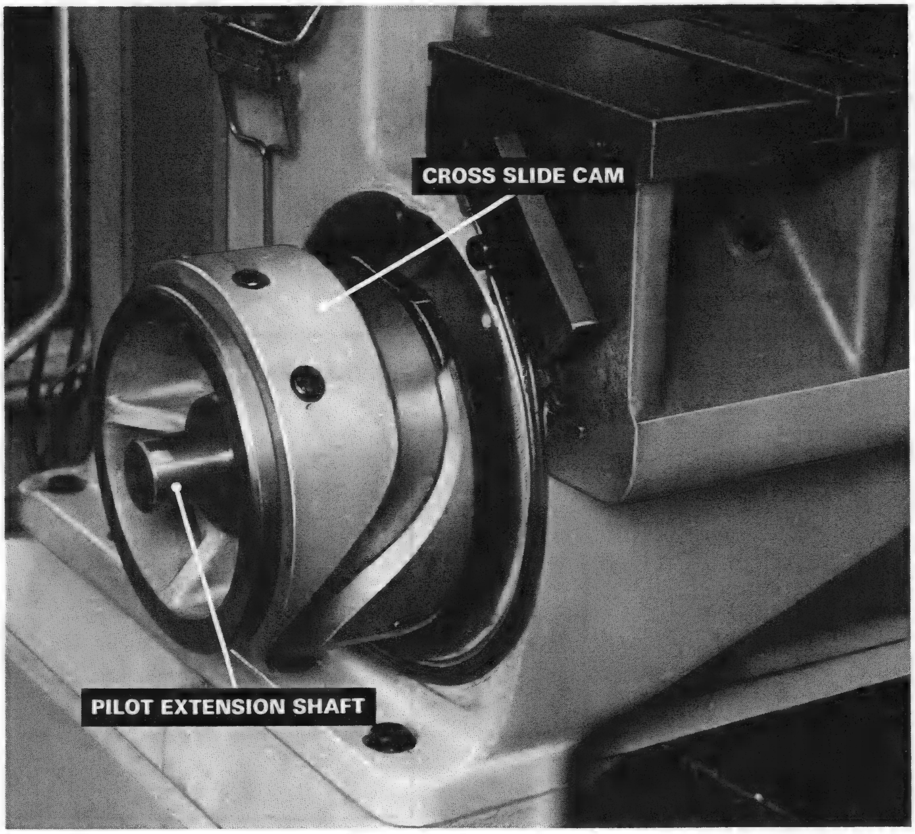


Fig. D-50. Slide lower cross slide cam drum out onto pilot extension shaft.

Machines Equipped with Double Cam Drum (9/16" and 1" RA-6, RAN-6; 3/4" RA-8 and 1 1/4" RA-6 machines)

Follow the same procedure for changing the *cams* on the *double cam drums* as described on section D, page 27, for machines equipped with a single set of *cams* on the *drum.* In the *double cam drum* arrangement, before the *drum* can be pulled out onto the *pilot extension,* the *upper cross slide lever cam roll assembly* must be unclamped and moved out of position. (Fig. D-51) Be sure the *upper cross slide cams* and *lower cross slide cams* are installed in the correct location on the *drum.* With the *double cam drum* construction, the *outer cams* operate the *upper cross slides* and the *inner cams* operate the *lower cross slides.* After the *drum* is placed back in position, move the *upper cross slide lever cam roll* back into the operating position. Clamp it firmly with the *binder screw* in the *lever,* allowing 1/16" running clearance between the *roll* and *cam drum* surface. (Fig. D-52)

> IMPORTANT: After cams are securely installed, check the complete cam track using a plug of the same diameter as the cam roll to assure that it can pass freely between the cams.

Apply a generous amount of grease to the working surfaces of the cams.

Machines Equipped with Drum Cam (7/16" machine)

With this style drum cam the procedure is similar to that described above for the independent cam style machines. With this style the entire drum cam is removed and replaced with a drum cam of the correct lead. Each cross slide has its own drum cam. (Fig. D-53) Apply a generous amount of grease to the working surfaces of the cams.

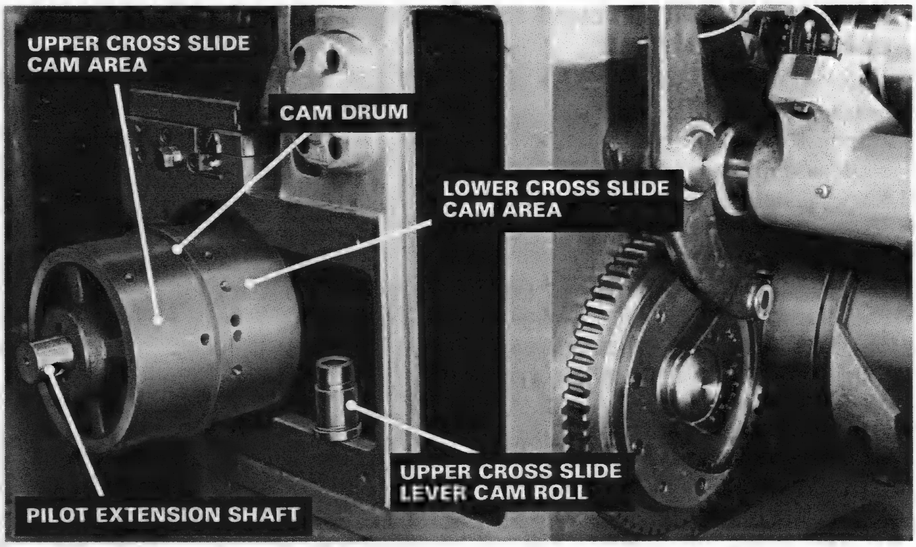

UPPER CROSS SLIDE CAM AREA
CAM DRUM
LOWER CROSS SLIDE CAM AREA
UPPER CROSS SLIDE LEVER CAM ROLL
PILOT EXTENSION SHAFT

Fig. D-51. Machine equipped with double cam drum.

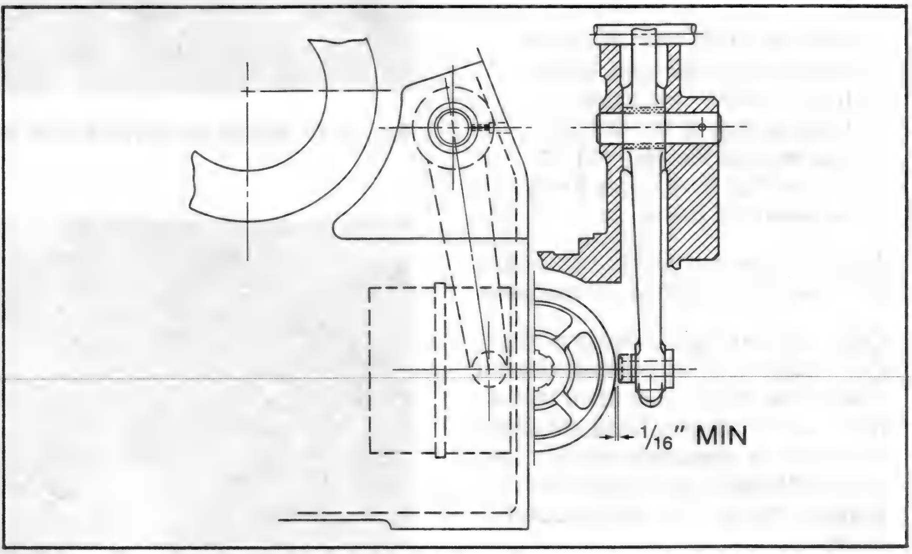


Fig. D-52. Allow 1/16" running clearance between roll and cam drum surface.

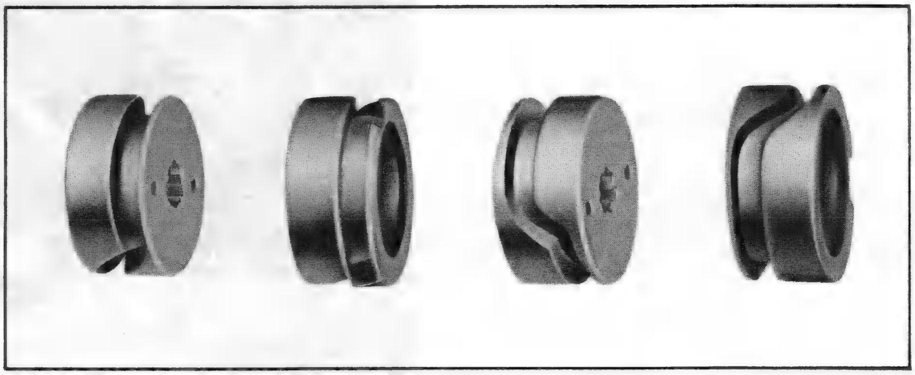


Fig. D-53. Typical drum cams. (7/16" RA-6)

10B. Change Intermediate Cross Slide Cams

NOTE: Where slides are equipped with a *stop screw*, back off the stop screw on both slides before proceeding.

Machines Equipped with Ring Type Cams

Crank or jog the machine to rotate the *intermediate cross slide cam drum* to a position where the *lead guard cam* can be removed. (Fig. D-54) Rotate the drum further and remove the *lead cam.* Clean the drum carefully. Install the *lead cam* specified on the Tooling Setup Chart. (Fig. D-47) Rotate the drum again and install the matching *lead guard cam.*

IMPORTANT: After the cams are securely installed, check the complete cam track, using a plug of the same diameter as the cam roll, to assure that it can pass freely between the cams.

Apply a generous amount of grease to the working surfaces of the cams.

Repeat this procedure with the *intermediate cross slide cams* on the opposite side of machine.

Machines Equipped with Disc Type Cams

Crank or jog machine to rotate the *intermediate cross slide cam disc* to a position where the *lead cam* can be removed. (Fig. D-55) Remove the *lead cam.* Clean the *disc* carefully. Install the *lead cam* specified on the Tooling Setup Chart. (Fig. D-47) The guard cam is universal and is used with all cam leads.

IMPORTANT: After the cams are securely installed, check the complete cam track, using a plug of the same diameter as the cam roll, to assure that it can pass freely between the cams.

Apply a generous amount of grease to the working surfaces of the cams.

Repeat this procedure with *intermediate cross slide cams* on the opposite side of machine.

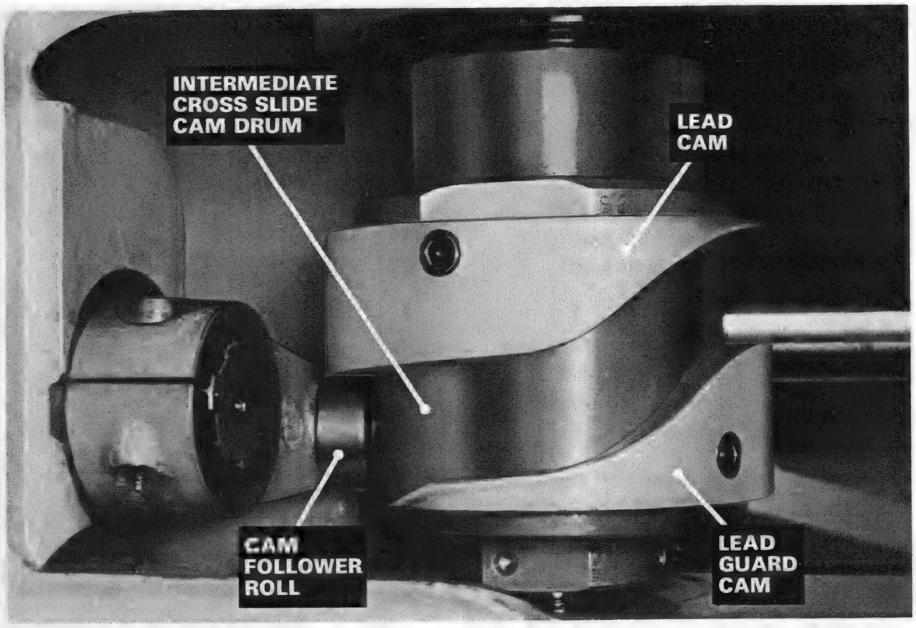


Fig. D-54. Ring type intermediate cross slide cam (fifth position on 2⅝" RB-6).

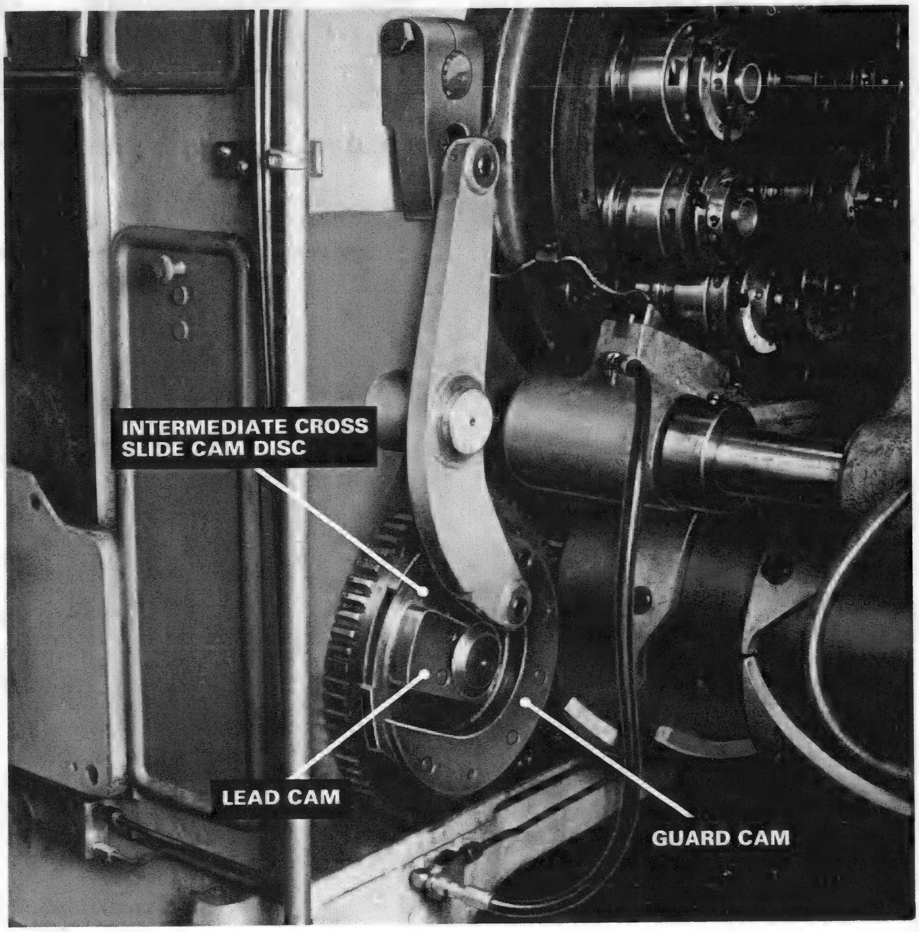


Fig. D-55. Disc type intermediate cross slide cam (¾" RA-8).

10C. Change Upper Cross Slide Cams

Machines Equipped with Top Slide Drum Shaft

CAUTION: Always use a fixed ladder to climb up on the machine and be sure all electrical, pneumatic and/or hydraulic power is turned OFF.

Loosen the binder screw and back off the *cross slide stop screw* of both *upper cross slides* before starting this procedure. (Fig. D-56)

Open the access doors on top of the machine. (Fig. D-57) Crank or jog the machine to rotate the *cam drums* to a position where the *lead guard cam* can be removed. (Fig. D-57) Rotate the drum farther and remove the *lead cam.* Clean the *drum* carefully. Install the *lead cam* specified on the Tooling Setup Chart. (Fig. D-47) Rotate the drum again and install the matching *lead guard cam.*

> IMPORTANT: After the cams are securely installed, check the complete cam track, using a plug of the same diameter as the cam roll, to assure that it can pass freely between the cams.

Apply a generous amount of grease to the working surfaces of the cams.

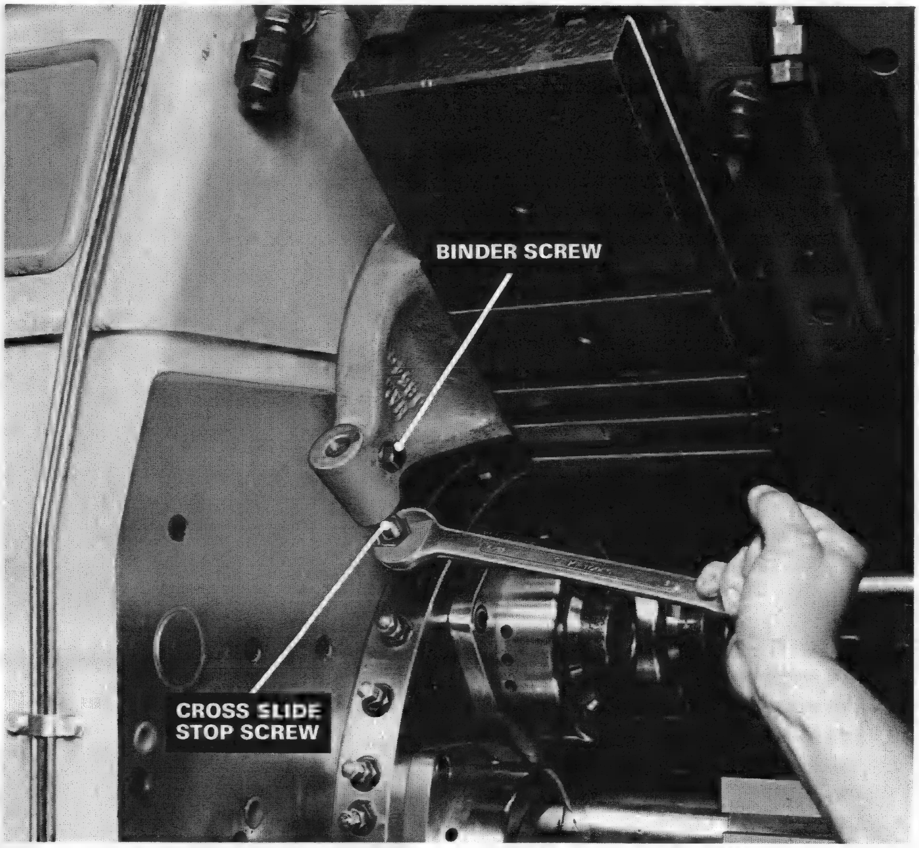

BINDER SCREW
CROSS SLIDE STOP SCREW

Fig. D-56. Back off cross slide stop screw.

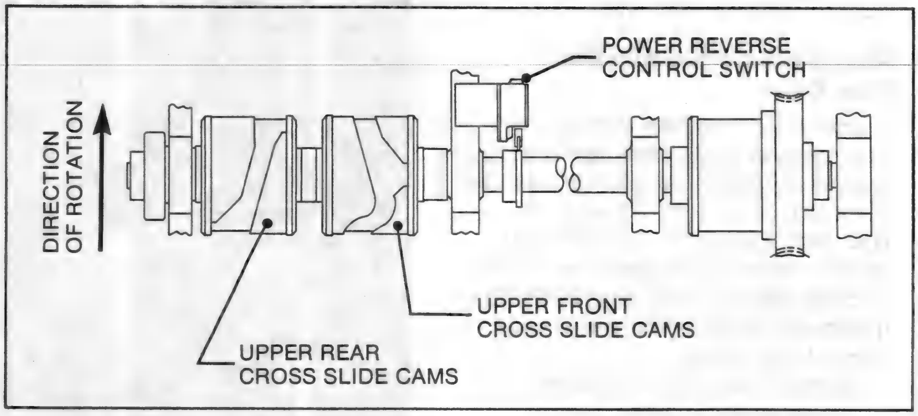

POWER REVERSE CONTROL SWITCH
DIRECTION OF ROTATION
UPPER FRONT CROSS SLIDE CAMS
UPPER REAR CROSS SLIDE CAMS

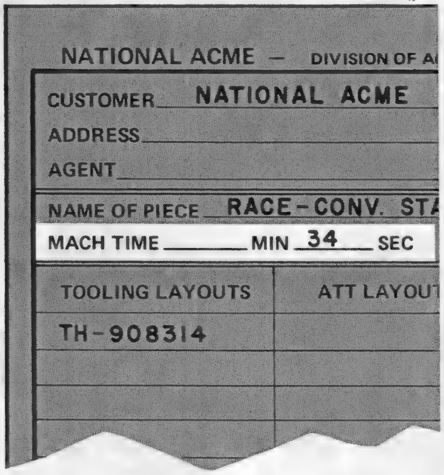
Fig. D-57. Drum type upper cross slide cams on top slide drum shaft assembly.

11. Check Machine Cycle Time

The machine cycle time for the job is given in the upper left-hand corner of the Tooling Setup Chart as shown in Fig. D-58. If the spindle and feed gears have been installed properly, the running time of the machine to make one complete cycle will agree with this figure.

Select one easily identified point of the machine cycle (such as when the *high speed lever* moves, engaging the high speed clutch) and run a stop watch check of the time it takes the machine to make ten complete cycles.

Then divide the total time on the stop watch by ten to get the actual time of one cycle. If this time does not agree with the "machine time" on the Tooling Setup Chart, recheck the installation of the spindle and feed gears. If they are installed correctly, then refer to the Troubleshooting section (section G, page 3) for other corrective actions.



NATIONAL ACME — DIVISION OF A

CUSTOMER NATIONAL ACME

ADDRESS

AGENT

NAME OF PIECE RACE-CONV. STA

MACH TIME ______ MIN 34 SEC

TOOLING LAYOUTS	ATT LAYOU
TH-908314	

Fig. D-58. Machine cycle time is given on Tooling Setup Chart.

12. Mount Cutoff Tool

CAUTION: Steps 12 thru 25 are tool setting procedures. The labor and time required can be greatly reduced by the careful use of the JOG mode. However, if the machine must be cranked, extreme caution should be exercised to insure that the main disconnect is in OFF position before engaging the *hand crank*. The *hand crank* must always be removed from the worm shaft when not cranking the machine and before starting the main drive motor.

The remainder of the machine setup procedure is devoted to setting the tools. It would be impossible to cover the hundreds of possible tool settings in this handbook. Therefore, an example part (Fig. D-59) and its Tooling Setup Chart (Fig. D-2) will be followed in explaining the tool setting procedure.

NOTE: Most experienced setup technicians mount the basic form, cutoff and drilling tools before proceeding to install the attachments. This is the procedure used in the following example.

Set the *cutoff blade* in the *cutoff toolholder* at the workbench. The *cutoff blade* must extend far enough from the *toolholder* so that, when it reaches its furthest advanced position while cutting, there is sufficient chip room and the toolholder will not hit the bar stock. Review the dimensions on the part drawing.

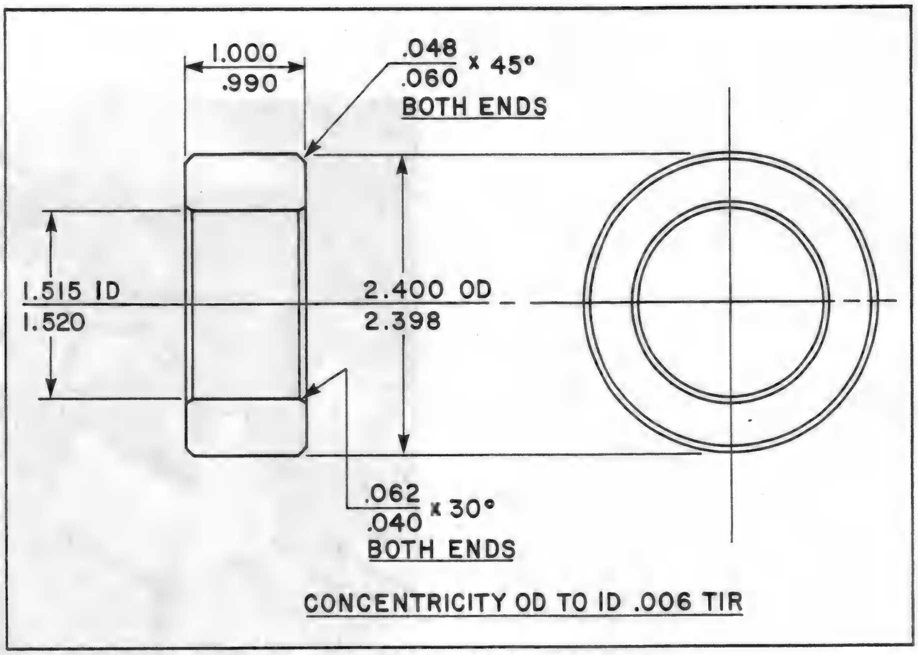


Fig. D-59. Drawing of a typical part used in example setup.

The cutoff tool in the example is mounted in the fifth position (six spindle machine). Using *adjusting screw "A" of cross slide,* position the *lateral adjusting wedge* so its elongated hole is centered on *hold down screw "B".* (Fig. D-60) Snug *hold down screw* so wedge can be adjusted in either direction to control the part length when making final adjustments. Crank or jog the machine until the slides reach high point. Mount the cutoff toolholder and blade assembly into the *intermediate cross slide.* (Fig. D-61)

NOTE: For details on how to set this tool on center, refer to Appendix section H, page 8.

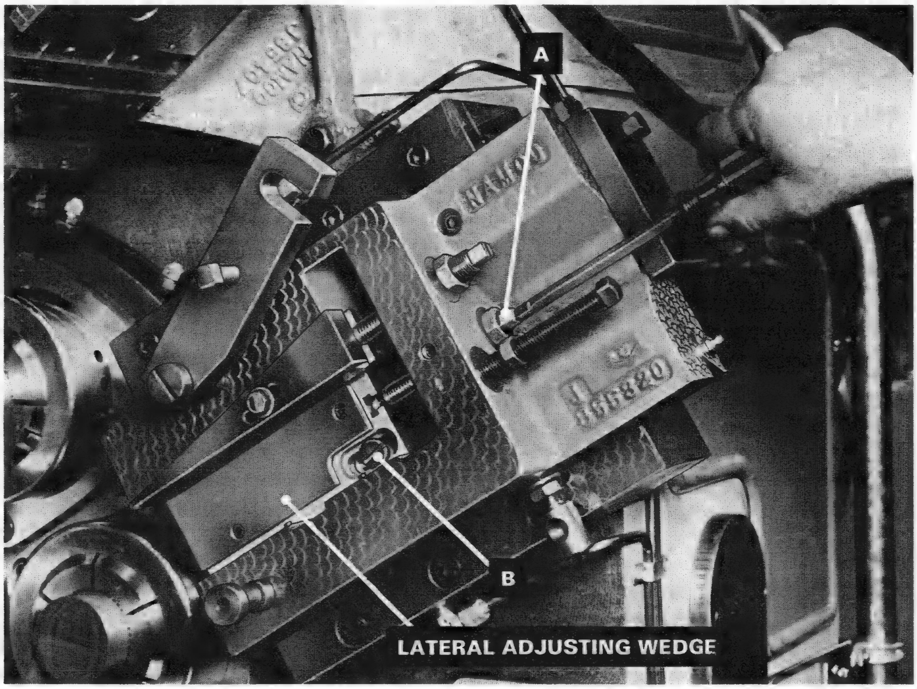


Fig. D-60. Use adjusting screw "A" to position lateral adjusting wedge.

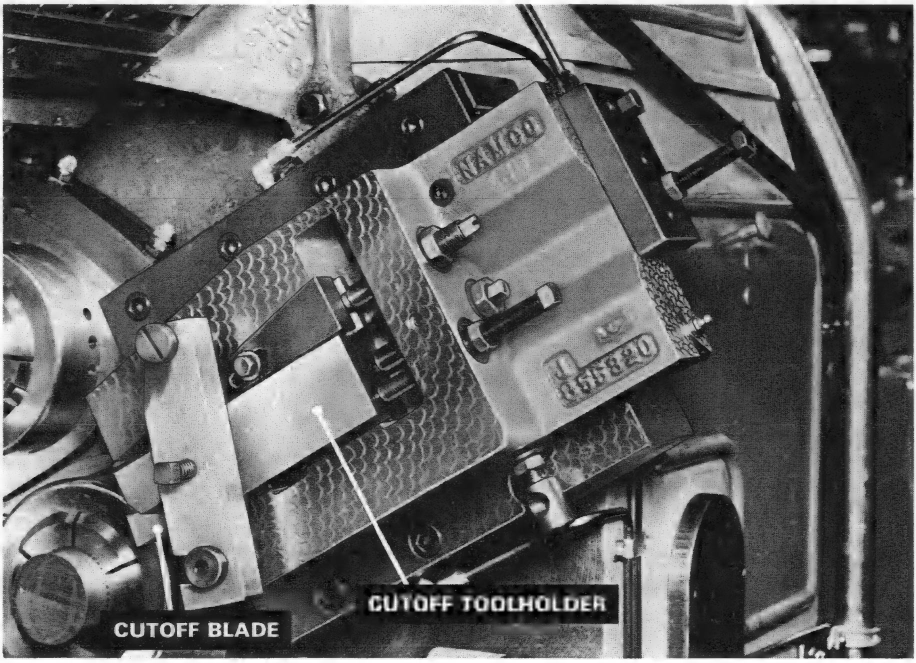


Fig. D-61. Mount cutoff toolholder and blade assembly into the intermediate cross slide.

13. Determine Length of Stock

13A. Determine Stock Needed for Part

Refer to the part drawing and determine the length of the part. In the example (Fig. D-59), this part is 1.000 inch long. Add 1/32 inch to this dimension for facing allowance. The part reference dimension, then, is 1 1/32 inch.

> NOTE: The 1/32 inch for facing is tentative for setup purposes only. This allowance will be refined to a minimum when making final adjustments.

13B. Measure to Cutoff Tool

Measure the distance from the outside surface of the *cutoff blade* to the face of the *work spindle nose.* (Fig. D-62) Record this dimension. (Example: 1 3/16 inch) Temporarily remove the *cutoff blade* and *holder.*

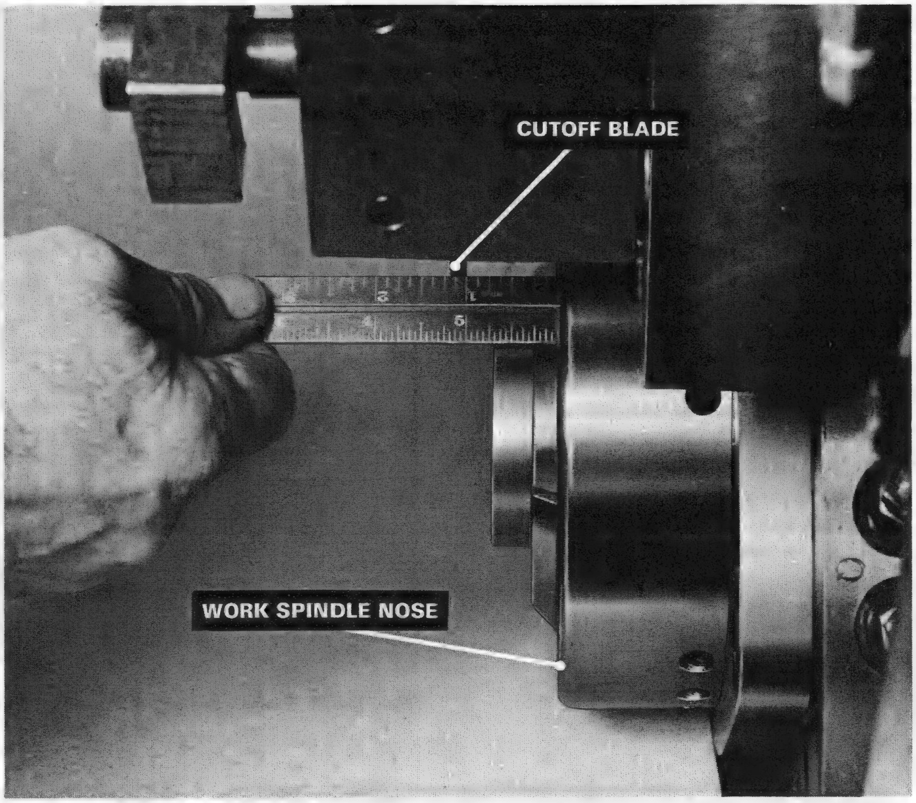


Fig. D-62. Cutoff tool measurement.

13C. Calculate Stock Stop Dimension

Add the part reference dimension (Step 13A) to the cutoff tool dimension (Step 13B). This is the total length of stock feedout required relative to the *work spindle nose.* (Example: 1 1/32 + 1 3/16 = 2 7/32)

14. Set Stock Stop

There are two types of *stock stops,* the slide type and the swing type. (Fig. D-64) Both types are set in the same manner.

Crank or jog the machine until the *stock stop* is in its full advanced position (high point on *stock stop relieving cam*). Locate the face of the *stock stop screw* to the work spindle using the dimension calculated in Step 13C (section D, page 33) by adjusting the *stock stop screw.* (Figs. D-63 and D-64) This is still an approximate setting. Reposition the *stock stop bracket* on the *stock stop plunger* when necessary to avoid excessive overhang of the *stock stop screw.*

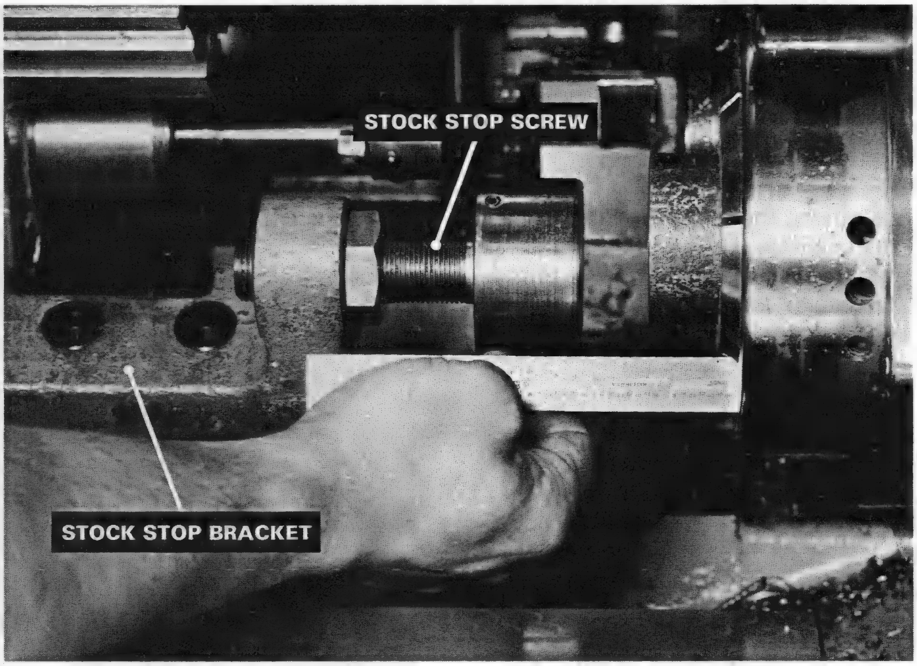

STOCK STOP SCREW
STOCK STOP BRACKET

Fig. D-63. Position face of stock stop screw.

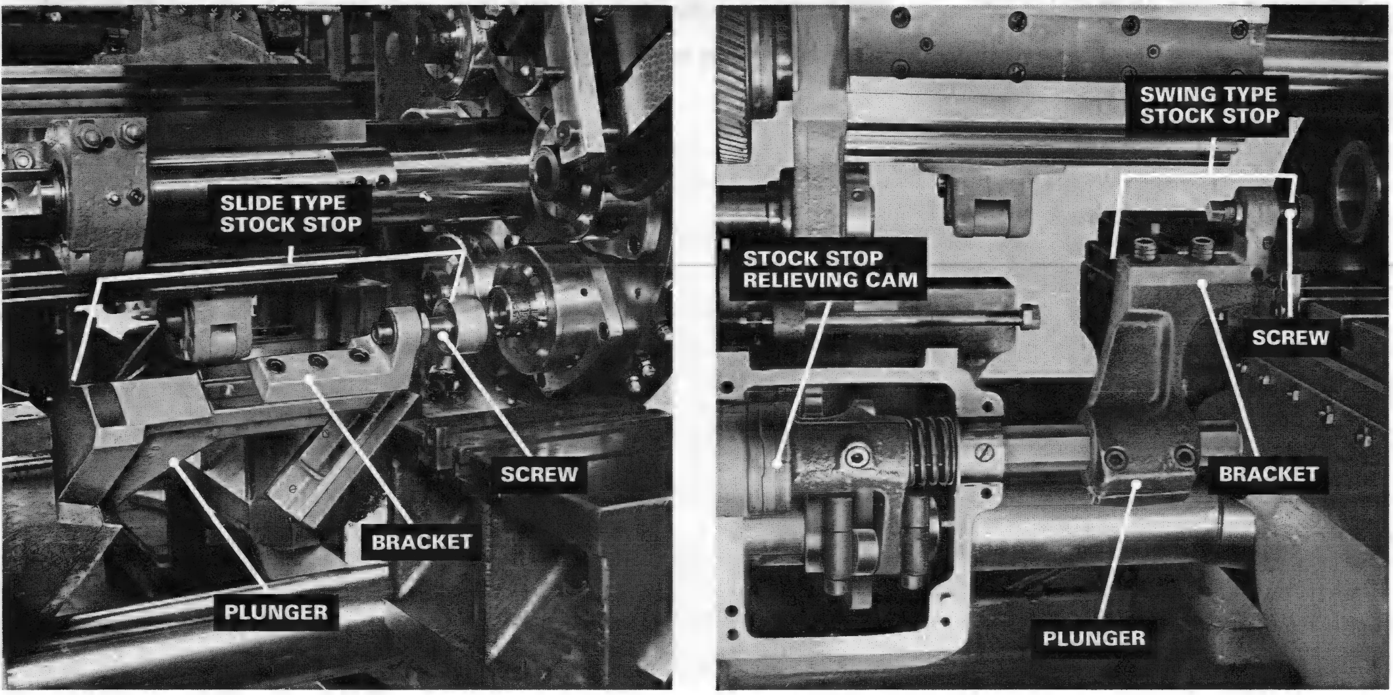

SLIDE TYPE STOCK STOP
SCREW
BRACKET
PLUNGER
SWING TYPE STOCK STOP
STOCK STOP RELIEVING CAM
SCREW
BRACKET
PLUNGER

Fig. D-64. Slide type (left photo) and swing type (right photo) stock stops.

15. Feed Out Test Bar

Crank or jog the machine until the *stock feed slide* is fully retracted. Temporarily replace the *chuck opening cam* and remove the stop block. Refer to Figs. D-34 and D-35.

Crank or jog the machine to feed out the test bar automatically to the *stock stop.* (Fig. D-65)

Stop the machine and again cancel the bar stock feeding action by removing the *chuck opening cam* and replacing the stop block. (See Step 6, section D, page 20.) This will keep additional bars from being fed out as you proceed thru the remainder of the tooling setup.

16. Move Test Bar to Cutoff Position

Progressively index the *spindle carrier* until the test bar reaches the cutoff position (fifth position in example). Continue running the machine until the cutoff *cross slide cam roll* is on the high point of its *cam.* Disengage the feed and stop the machine.

> NOTE: Experienced operators reduce the time required to index test bar from sixth to fifth position by manually engaging the high speed clutch during the machining portion of each cycle with the *manual high speed lever.* (Fig. D-66)
>
> **CAUTION: The *manual high speed lever* activating the *high speed clutch* is used for setup purposes ONLY. Never engage the *high speed clutch* during the machining portion of a cycle when the machine is stocked and the cutting tools are in position to cut.**

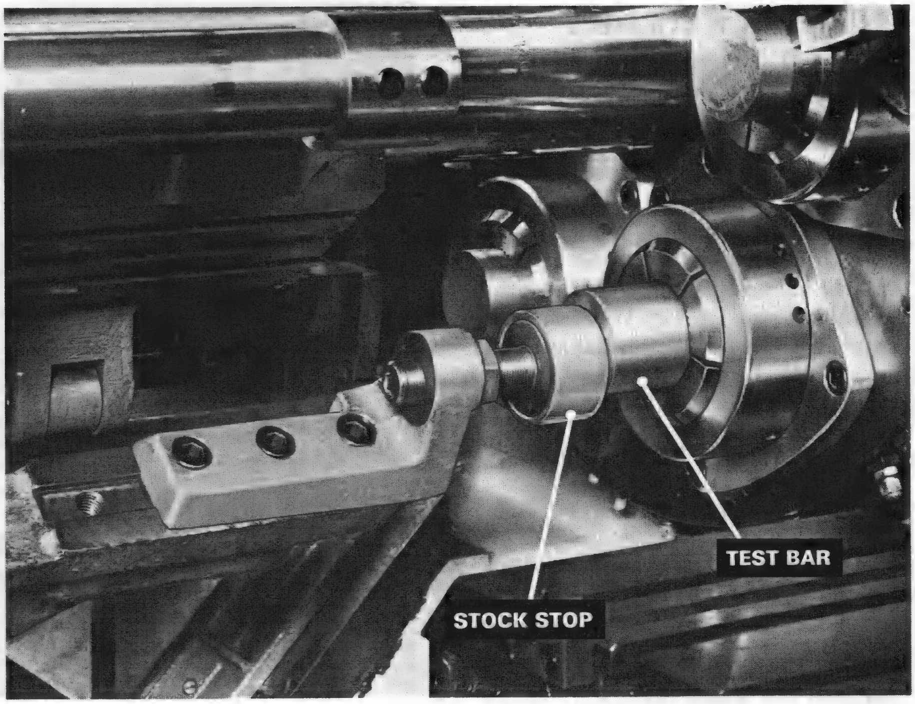


Fig. D-65. Feed out test bar to stock stop.

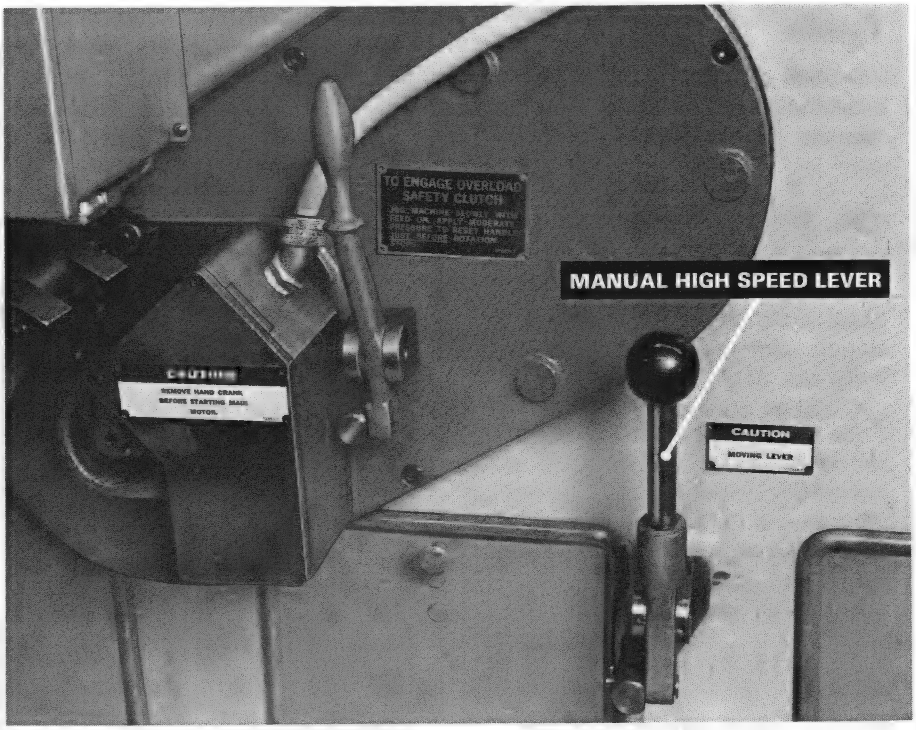

TO ENGAGE OVERLOAD SAFETY CLUTCH
MANUAL HIGH SPEED LEVER
CAUTION
REMOVE HAND CRANK BEFORE STARTING MAIN MOTOR
CAUTION
MOVING LEVER

Fig. D-66. Manual high speed lever used to engage high speed clutch.

17. Mark Part with Cutoff Tool

Reinstall the cutoff blade and toolholder assembly into the fifth position intermediate cross slide so that the cutting tip of the blade is approximately 1/16 inch short of contacting the bar stock. Snug the *lateral hold down screw* and *lower clamping screws* (Fig. D-67) finger tight to allow for further adjustments.

With the feed disengaged, jog or run the main drive motor so only the spindles rotate. While the bar stock is rotating, use the *tool positioning screw* to slowly advance the cutoff tool until a shallow groove is cut in the test bar. (Fig. D-68) This groove is the lateral reference point on the bar from which all other tools will be set.

Tighten the *lateral hold down screw* and *lower clamping screws.*

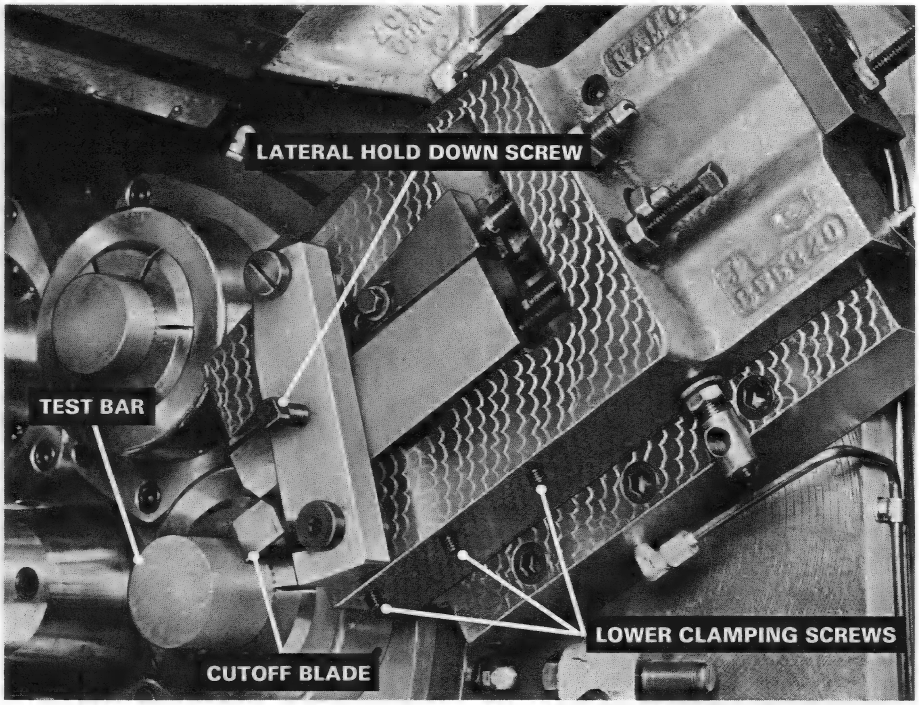


Fig. D-67. Reinstall cutoff blade and toolholder assembly in fifth position.

18. Set Sixth Position Tools

The sixth position operations on the Tooling Setup Chart (Fig. D-2) are to face the end of the part and spot drill.

18A. Set Toolholders

In setting toolholders, it is best to start with the last numbered spindle position (fourth position on a 4-spindle machine, sixth position on a 6-spindle machine and eighth position on an 8-spindle machine) since this is the beginning of the sequence of cutting operations. If the job requires preforming or predrilling on the work before cutoff and stock advance, then it will be necessary to set the tooling for position or positions where this work is done prior to cutoff. Both cross slide and end toolslide toolholders should be mounted and set at each spindle position before advancing to the next. The part will then be progressively machined.

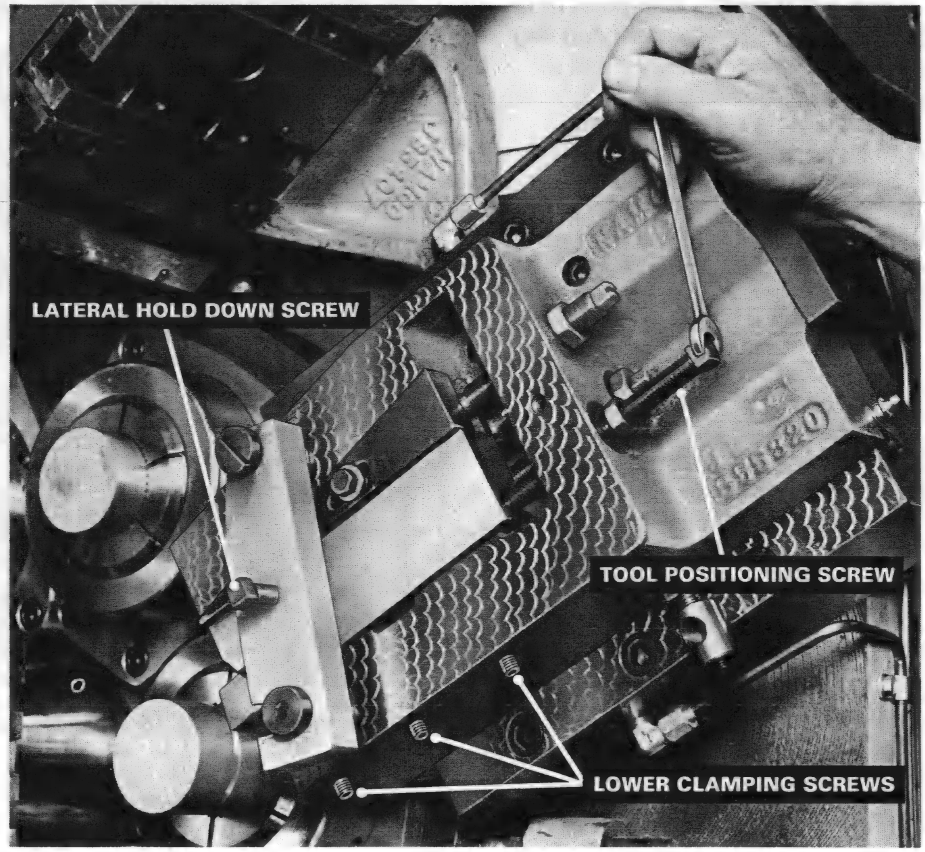


Fig. D-68. Cut shallow groove in test bar.

18B. Set Cross Slide Tool

Run the machine so the test bar indexes to the sixth position.

> NOTE: Any time during setup that the machine is indexed, be sure the retracted tools clear both the indexing work piece and the *stock stop* in its furthest advanced position.

Continue to run the machine until the *end toolslide guide bracket* just contacts the *end toolslide stop nuts.* (Fig. D-69) This is the high point of the machine. Stop the machine at this point.

Loosen the *locking screws* of the sixth position *cross slide.* (Fig. D-70) Use the *cross slide adjusting screw* (Figs. D-71 and D-76) to move the *cross slide* back far enough so that the tool will not contact the test bar when the tool is installed. (For box type cross slides see Fig. D-71.)

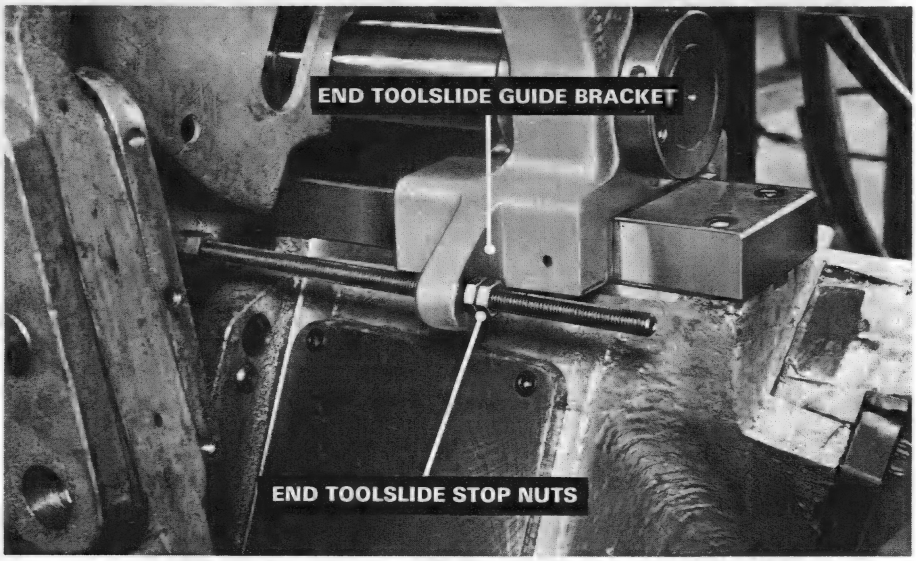

END TOOLSLIDE GUIDE BRACKET
END TOOLSLIDE STOP NUTS

Fig. D-69. High point is reached when toolslide guide bracket reaches stop nuts.

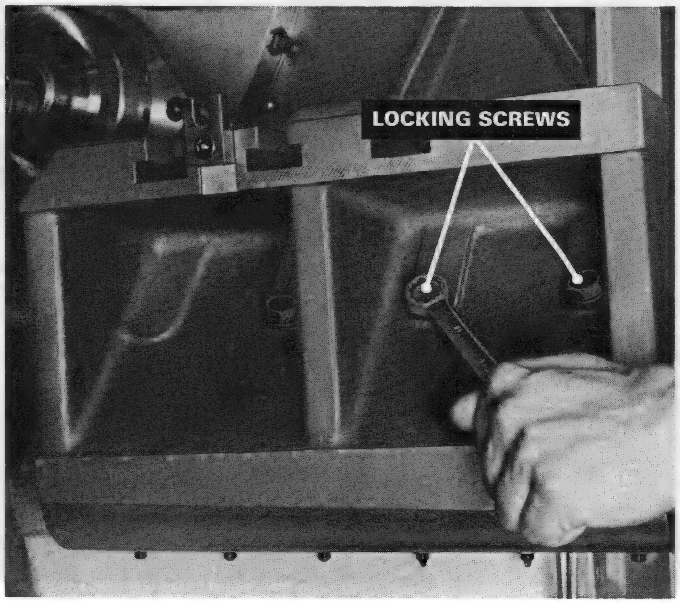

LOCKING SCREWS

Fig. D-70. Loosen locking screws on sixth position cross slide (2$\frac{5}{8}$" RB-6).

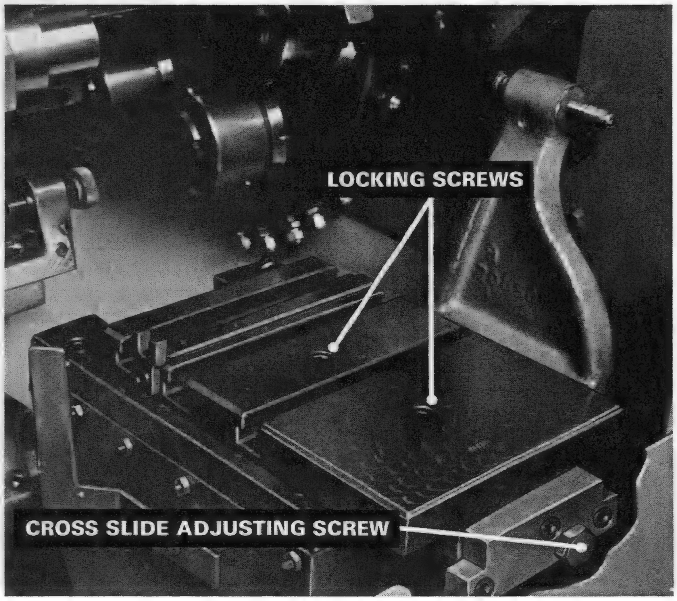

LOCKING SCREWS
CROSS SLIDE ADJUSTING SCREW

Fig. D-71. Loosen locking screws on sixth position box type cross slide.

Mount the assembled facing tool and toolholder on the sixth position *cross slide.* Referring to the part drawing, laterally position the facing tool with respect to the cutoff groove on the test bar using the *lateral adjusting screw.* (Fig. D-72)

With the feed disengaged, jog or run the *main drive motor* so only the *spindles* rotate. While the bar stock is rotating, use the *cross slide adjusting screw* (Fig. D-70) to slowly move the facing tool into the bar stock until the desired depth of cut is reached, maintaining clearance between the *cross slide stop screw* and the *spindle carrier stop screw.* (Fig. D-48) Stop the machine, tighten the *cross slide locking screws* and lock the *cross slide stop screw* clear of the *spindle carrier stop screw* (no stop pressure required).

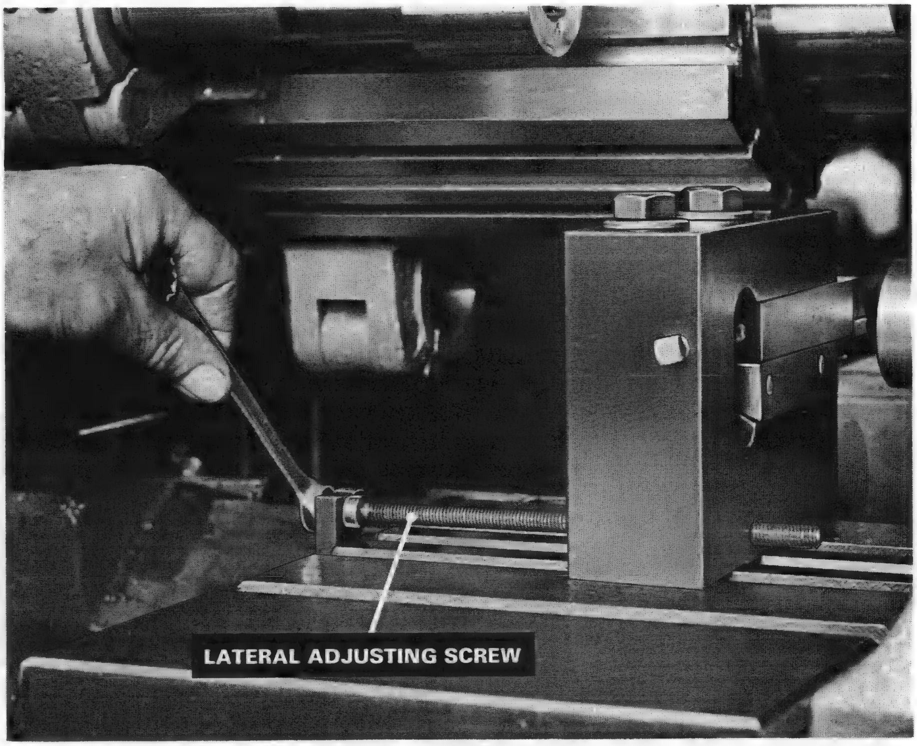


Fig. D-72. Mount facing tool and toolholder assembly on sixth position cross slide and position with lateral adjusting screw.

18C. Mount End Toolslide Toolholders

Estimate the location for the end toolslide toolholder in relation to the work piece and as close as practical to the work piece for maximum tool rigidity. Allow ample clearance for chips and toolholders on *cross slides.* Each end toolslide toolholder is stamped with its position and machine serial number. Mount the end toolslide toolholder on the *end toolslide* with these markings facing the *gearbox.* Position it in its estimated location and snug down the four mounting screws.

18D. Set End Toolslide Tool

Mount the preassembled chuck and drill in the standard end toolslide toolholder. To avoid tool interference, position the drill radially in the toolholder so the facing tool on the *cross slide* will enter the flute of the drill when making the facing cut. (Fig. D-73) Snug down the *clamping nuts.*

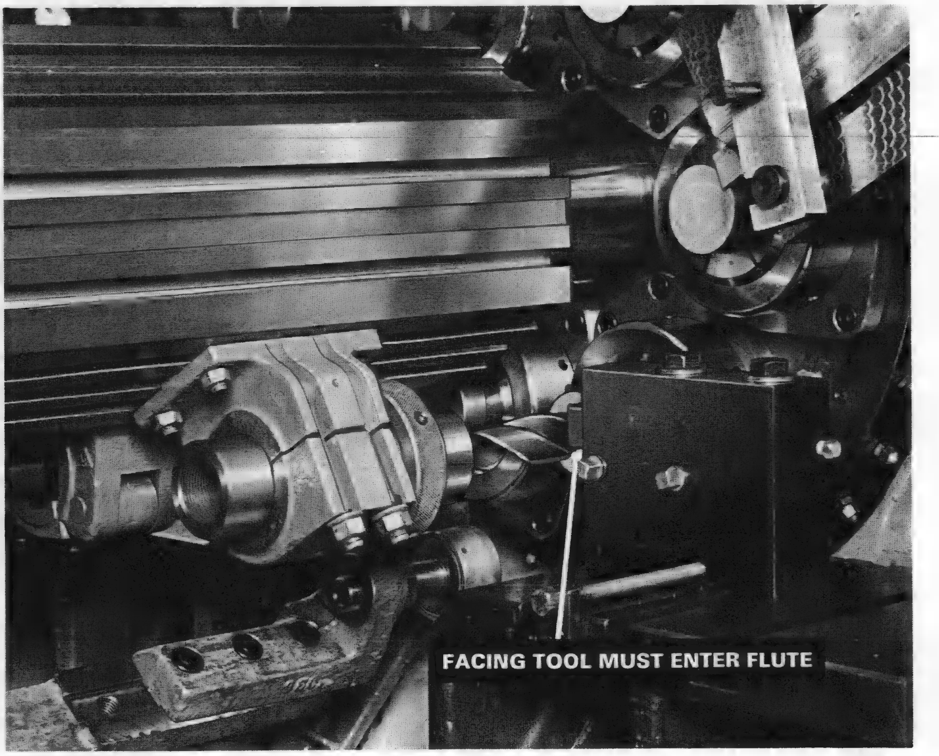


Fig. D-73. Mount drill and toolholder on end toolslide and position drill so facing tool will enter flute of drill.

With the *end toolslide* at high point, position the toolholder so the point of the drill just contacts the work piece. Tighten the toolholder's mounting screws securely. Crank or jog the machine in reverse to fully retract the *end toolslide.* Move the drill and chuck toward the work piece a distance equal to the desired depth of cut. (Fig. D-74) Clamp the drill and chuck in place.

Run the machine to high point so the drill will make the first test cut. Stop the machine. Crank or jog the machine in reverse to retract the *end toolslide.* Check the depth of cut against the desired depth and adjust the position of the drill as necessary.

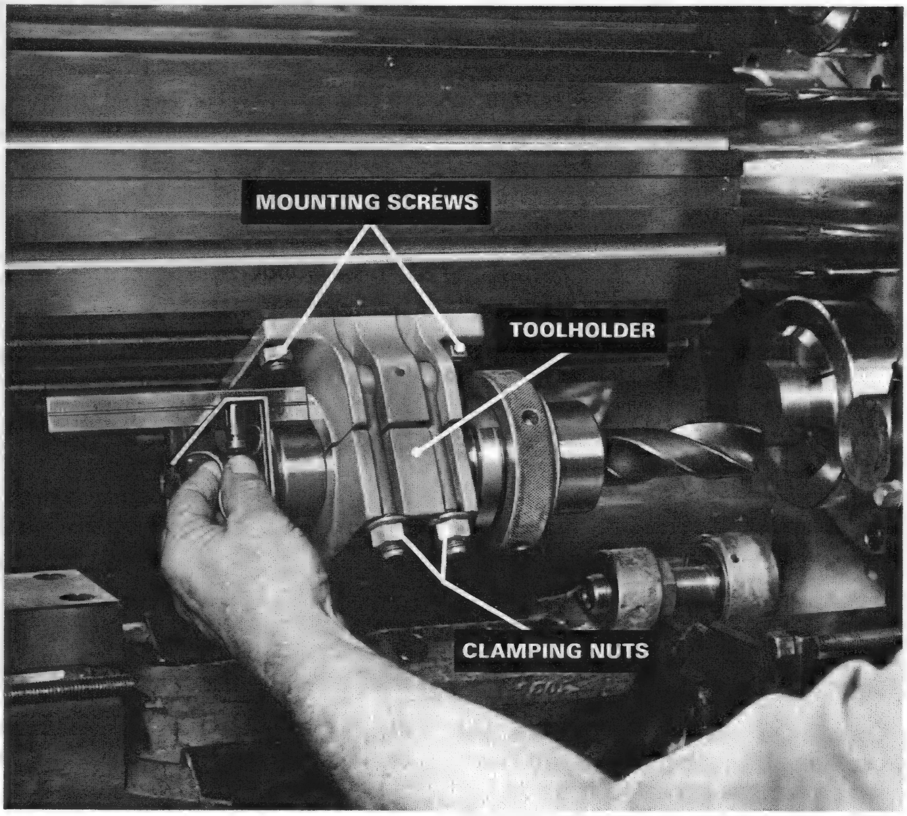


Fig. D-74. Position drill and chuck for proper depth of cut.

19. Set First Position Tools

The first position operations on the Tooling Setup Chart (Fig. D-2) are to finish form the OD, breakdown for cutoff and drill part way.

19A. Set Cross Slide Tool

Run the machine so the test bar indexes to the first position.

> NOTE: Any time during setup that the machine is indexed, be sure the retracted tools clear both the indexing work piece and the *stock stop* in its furthest advanced position.

Continue to run the machine until the *end toolslide guide bracket* just contacts the *end toolslide stop nuts.* (Fig. D-69) Stop the machine at this point.

Loosen the *locking screws* of the first position *cross slide.* (Fig. D-70) Use the *cross slide adjusting screw* to move the *cross slide* back far enough so the tool will not contact the work piece when the tool is installed. (Fig. D-76)

Mount the assembled form tool and toolholder on the first position *cross slide.* Referring to the part drawing, position the form tool with respect to the cutoff groove on the test bar using the *lateral adjusting screw.* (Fig. D-75)

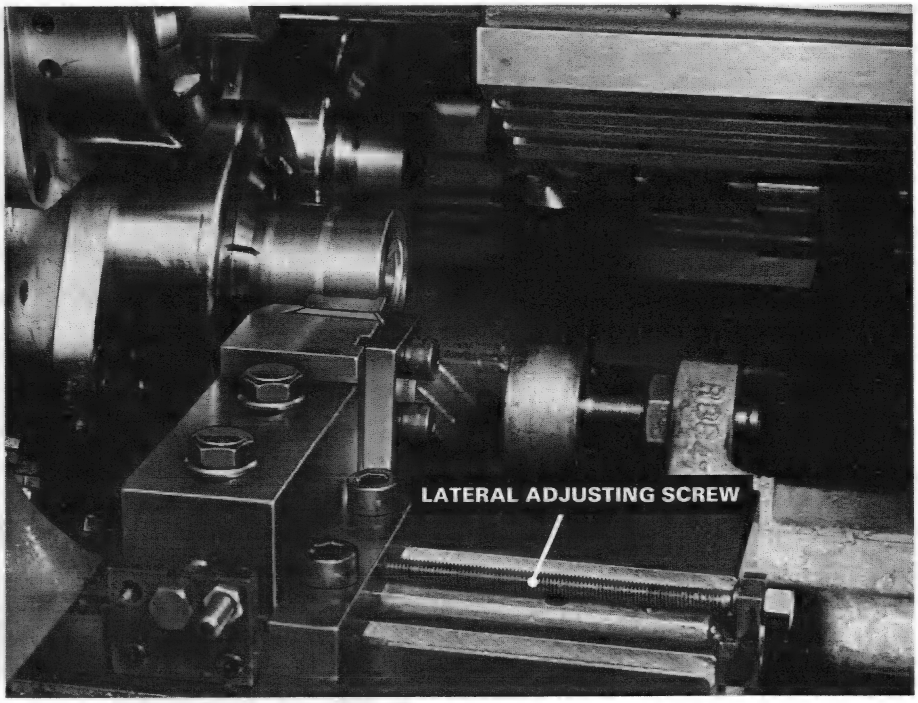


Fig. D-75. Mount form tool and toolholder assembly on first position cross slide and position with lateral adjusting screw.

With the feed disengaged, jog or run the *main drive motor* so only the *spindles* rotate. While the bar stock is rotating, use the *cross slide adjusting screw* (Fig. D-76) to slowly move the form tool into the work piece until the part diameter is 0.010 inch smaller than desired, maintaining clearance between the *cross slide stop screw* and the *spindle carrier stop screw.* (Fig. D-77) Stop the machine and tighten the *cross slide locking screws.* (Fig. D-70)

19B. Set Cross Slide Stop Screw

Loosen the *binder screw* on the *cross slide stop screw.* (Fig. D-77) Bring the *cross slide stop screw* up to where it just contacts the *spindle carrier stop screw.* Then turn the *cross slide stop screw* one sixth of a turn farther (one flat of the hexagon) and clamp in place with the *binder screw.* This gives the *cross slide* approximately 0.005 inch stop pressure. The form tool will now cut a diameter that is 0.010 inch larger than previously set, bringing the diameter to its correct size. Note that in the example this diameter should be approximately 0.008 inch larger than the finished diameter shown on the part drawing to allow adequate material for the shaving operation.

> NOTE: In any setup, once the stop pressure has been set for a cross slide, any further adjustment for part size should be made by toolholder adjustments only.

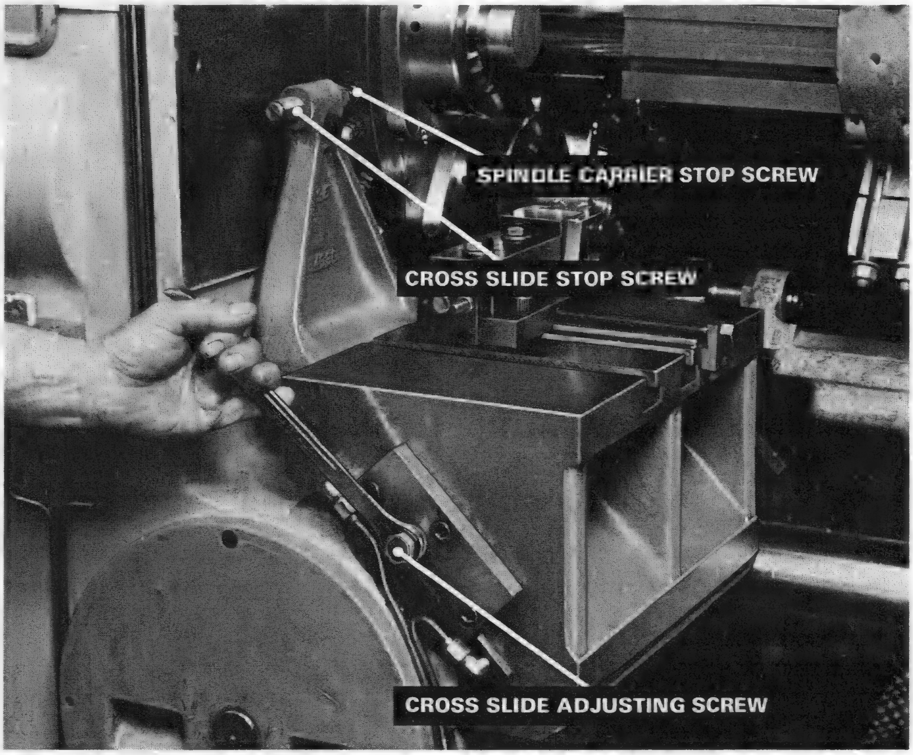


Fig. D-76. Use cross slide adjusting screw to move form tool into work piece.

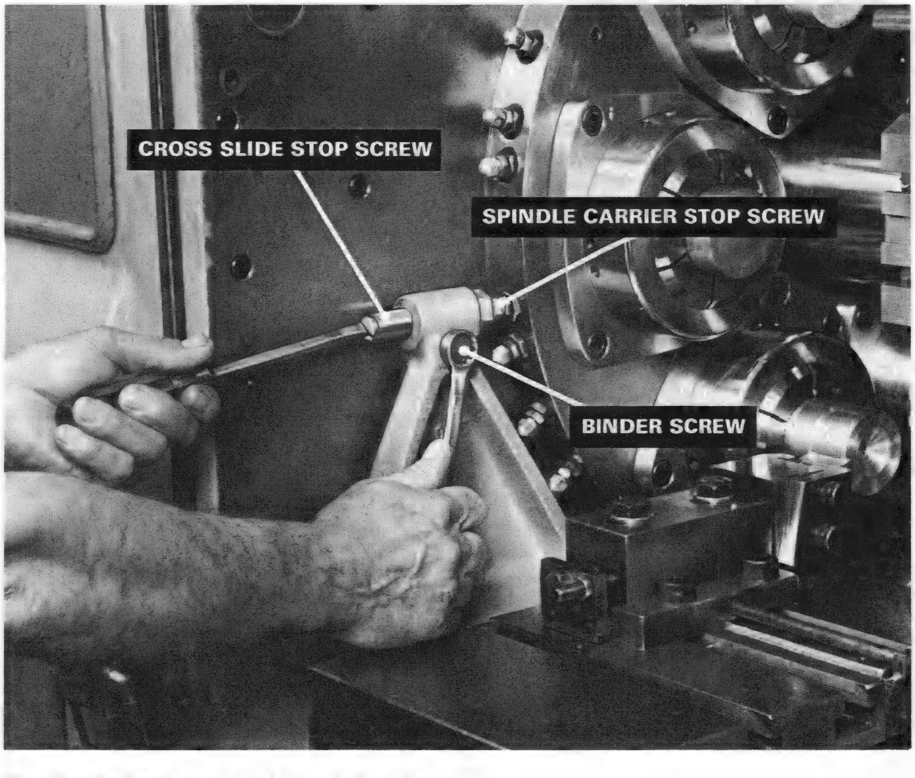


Fig. D-77. Set cross slide stop pressure.

19C. Mount End Toolslide Toolholder

Estimate the location for the end toolslide toolholder in relation to the work piece and as close as practical to the work piece for maximum tool rigidity. Allow ample clearance for chips and toolholders on *cross slides.* Each end toolslide toolholder is stamped with its position and machine serial number. Mount the end toolslide toolholder on the *end toolslide* with these markings facing the *gearbox.* Position it in its estimated location and snug down the four mounting screws.

19D. Set End Toolslide Tool

Mount the assembled chuck and drill in the standard end toolslide toolholder. (Fig. D-78) Snug down the *clamping nuts.*

With the *end toolslide* at high point, position the toolholder so the point of the drill contacts the bottom of the previously drilled hole. Tighten the toolholder's mounting screws securely. Crank or jog the machine in reverse to fully retract the *end toolslide.* Move the drill and chuck toward the work piece a distance equal to the desired depth of cut. (Fig. D-78) Clamp the drill and chuck in place with the *clamping nuts.*

Run the machine to high point so the drill will make the first test cut. Stop the machine. Crank or jog the machine in reverse to retract the *end toolslide.* Check the depth of cut against the desired depth and adjust the position of the drill as necessary.

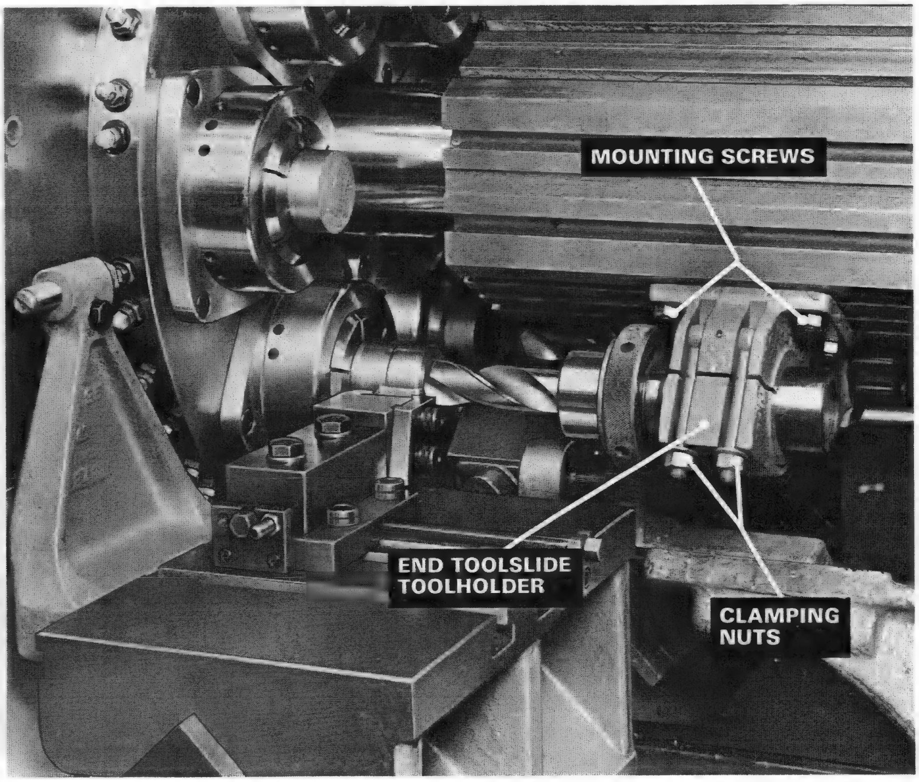


Fig. D-78. Mount drill and toolholder on first position end toolslide.

20. Set Second Position Tools

The second position operation on the Tooling Setup Chart (Fig. D-2) is to drill the remainder of the hole.

20A. Set End Toolslide Tools

Run the machine so the test bar indexes to the second position.

> NOTE: Any time during setup that the machine is indexed, be sure the retracted tools clear both the indexing work piece and the *stock stop* in its furthest advanced position.

Continue to run the machine until the *end toolslide guide bracket* just contacts the *end toolslide stop nuts.* (Fig. D-69) Stop the machine at this point.

20B. Mount End Toolslide Toolholder

Estimate the location for the end toolslide toolholder in relation to the work piece and as close as practical to the work piece for maximum tool rigidity. Allow ample clearance for chips and toolholders on *cross slides.* Each end toolslide toolholder is stamped with its position and machine serial number. Mount the end toolslide toolholder on the *end toolslide* with these markings facing the *gearbox.* Position it in its estimated location and snug down the four mounting screws.

Mount the assembled chuck and drill in the standard end toolslide toolholder. (Fig. D-79) Snug down the *clamping nuts.*

With the *end toolslide* at high point, position the toolholder so the point of the drill contacts the bottom of the previously drilled hole. Tighten the toolholder's mounting screws securely. Crank or jog the machine in reverse to fully retract the *end toolslide.* Move the drill and chuck toward the work piece a distance equal to the desired depth of cut. (Fig. D-79) Clamp the drill and chuck in place with the *clamping nuts.*

Run the machine to high point so the drill will make the first test cut. Stop the machine. Crank or jog the machine in reverse to retract the *end toolslide.* Check the depth of cut against the desired depth and adjust the position of the drill as necessary.

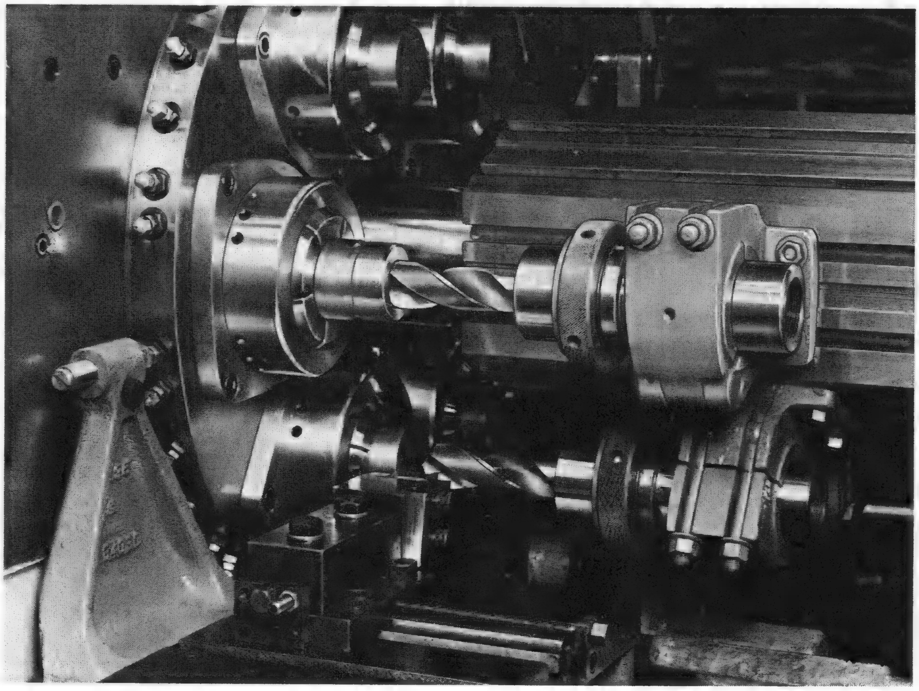


Fig. D-79. Mount drill and toolholder on second position of the end toolslide.

21. Set Third Position Tools

The third position operations on the Tooling Setup Chart (Fig. D-2) are cutoff part way and recess chamfer the front and rear ID.

21A. Set Cross Slide Tool

Run the machine so the test bar indexes to the third position.

> NOTE: Any time during setup that the machine is indexed, be sure the retracted tools clear both the indexing work piece and the *stock stop* in its furthest advanced position.

Continue to run the machine until the *end toolslide guide bracket* just contacts the *end toolslide stop nuts.* (Fig. D-69) Stop the machine at this point.

Loosen the *locking screws* of the third position *cross slide.* (Fig. D-80) Use the *cross slide adjusting screw* to move the cross slide back far enough so the tool will not contact the test bar when the assembled cutoff blade and toolholder are installed.

Mount the assembled cutoff blade and toolholder on the third position *cross slide* and position the tool laterally with respect to the partial cutoff groove using the *lateral adjusting screw.* (Fig. D-80) Clamp the toolholder in place.

With the feed disengaged, jog or run the *main drive motor* so only the spindles rotate. While the bar stock is rotating, use the *cross slide adjusting screw* to slowly move the cutoff blade into the bar stock until the groove is at the desired diameter, maintaining clearance between the *cross slide stop screw* and the *spindle carrier stop screw.* (Fig. D-80) Stop the machine, tighten the *cross slide locking screws* and lock the *cross slide stop screw* (no stop pressure required).

21B. Set End Toolslide Tools

Working at the bench and referring to Fig. D-81, start by mounting the *tool block* on the recessing fixture.

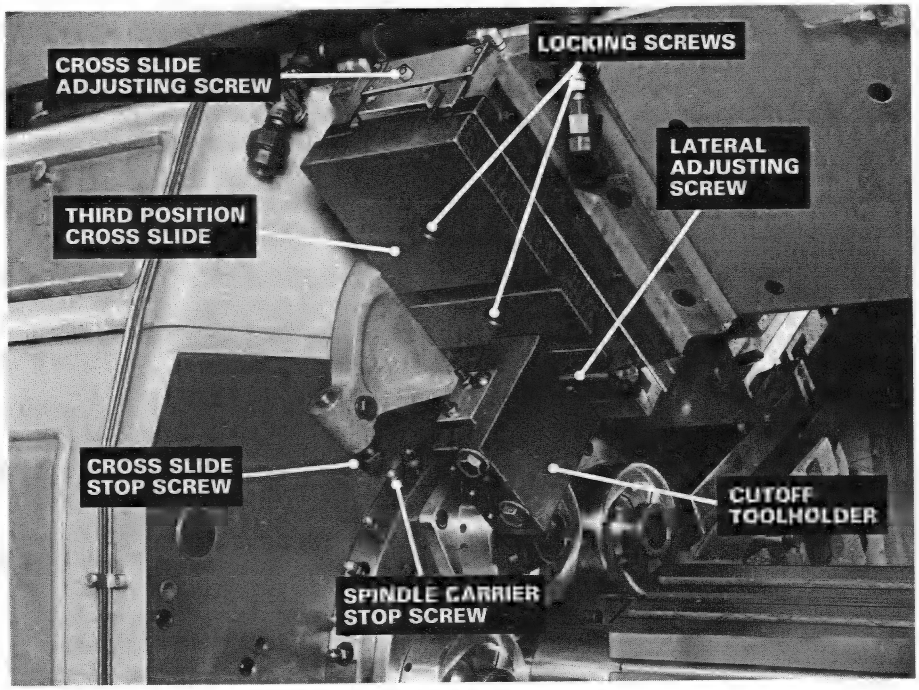

CROSS SLIDE ADJUSTING SCREW
LOCKING SCREWS
LATERAL ADJUSTING SCREW
THIRD POSITION CROSS SLIDE
CROSS SLIDE STOP SCREW
CUTOFF TOOLHOLDER
SPINDLE CARRIER STOP SCREW

Fig. D-80. Mount cutoff blade and toolholder assembly on third position cross slide and position with lateral adjusting screw.

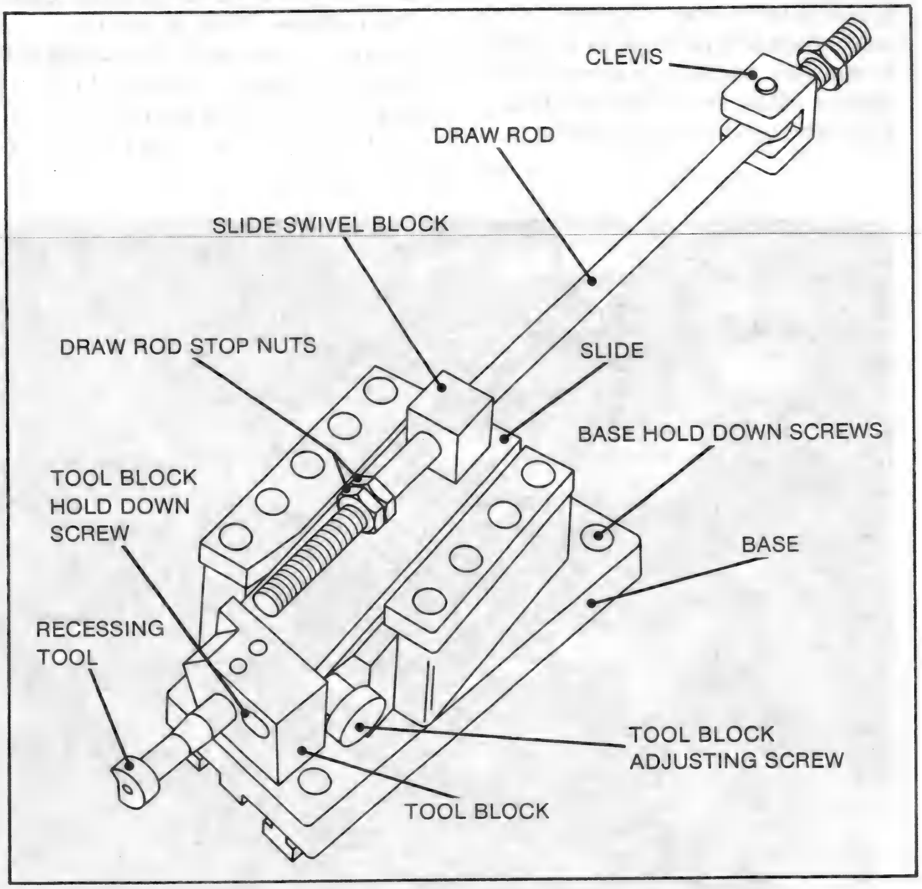

CLEVIS
DRAW ROD
SLIDE SWIVEL BLOCK
DRAW ROD STOP NUTS
SLIDE
BASE HOLD DOWN SCREWS
TOOL BLOCK HOLD DOWN SCREW
BASE
RECESSING TOOL
TOOL BLOCK ADJUSTING SCREW
TOOL BLOCK

Fig. D-81. Principle parts of a typical flat type recessing fixture.

The elongated holes in the *tool block* should be centered on the *tool block hold down screws* to allow for equal adjustment in either direction.

Insert the *recessing tool* into the *tool block* making sure it is bottomed in its hole. Rotate the tool so its cutting edge will be on the horizontal centerline of the work piece. (Refer to the toolslide dimensions on Fig. D-3, section D, page 4, for location data.) This position can be established by measuring or gaging from the bottom of the fixture's *base* to the cutting edge of the tool. (Fig. D-82) In the example, this dimension is 3.000 inches. Clamp the tool in place.

With the machine at high point, mount the recessing fixture on the *end toolslide.* Position fixture so the end of the tool is near the end of the work piece. Tighten *base hold down screws* finger tight.

Back off the *draw rod stop nuts.* Fasten the clevis end of the *draw bar* to the *gearbox plug assembly* in the gearbox wall. Rotate the *clevis* to a position where it will not bind the *draw bar* as the *end toolslide* advances and the *draw bar* pivots.

Adjust the *slide* backward or forward, using the *slide stop nuts,* to position the tool so it will enter the drilled hole in the work piece with proper clearance. (Fig. D-83) Lock the *slide stop nuts* at this position.

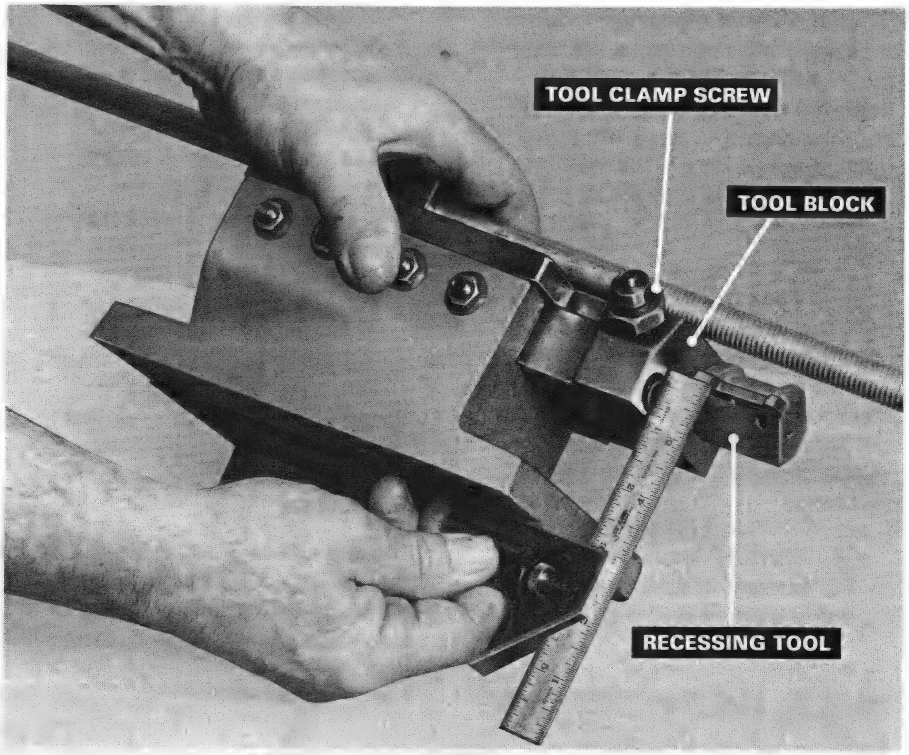


Fig. D-82. Position cutting edge of tool by measuring from base of fixture.

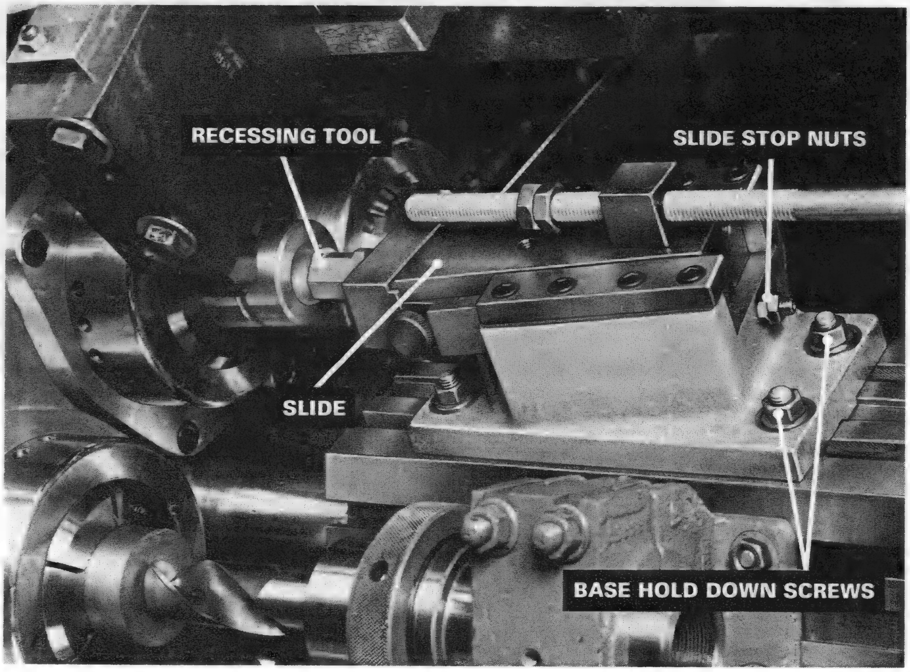


Fig. D-83. Position recessing tool so it will enter work piece.

Move the entire recessing fixture forward on the *end toolslide* until the tool is at its full forward cutting position. Secure the fixture to the *end toolslide* with the *base hold down screws*. Screw the *draw rod stop nuts* until they contact the *slide swivel block* and lock in place. (Fig. D-84)

Crank or jog the machine in reverse until the low point is reached and stop. Loosen the *base hold down screws* and move the *base* forward a distance that will cause the tool to cut the desired recess diameter depth. Secure the base to the end toolslide.

> NOTE: The angle of the slideways of the base and the amount of end toolslide travel determine the amount of lateral travel of the recessing tool. Where the slideways angle is 10°, the recessing tool travel is 0.17 inch for each 1.00 inch of end toolslide travel. Where the angle is 15°, the recessing tool travel is 0.26 inch for each 1.00 inch of end toolslide travel. (Fig. D-85) Example: For a $\frac{3}{32}$-inch lateral travel of a recessing tool using a fixture with a 10° slideways angle, divide 0.093 by 0.17 and get the answer 0.547 inch. Move the base forward this distance.

Jog the machine to high point so the recess tool will make the first test cut. Stop the machine. Crank or jog the machine in reverse to retract the *end toolslide*. Check the diameter and axial location of the recess cut. Adjust the fixture position if necessary.

> NOTE: The entire fixture must be moved on the *end toolslide* to increase or decrease the diameter being cut. The diameter can also be changed by adjusting the *draw rod stop nuts*. However, this also changes the axial position of the tool. There is also some adjustment that can be made to the diameter by moving the *tool block*. When this action is taken, however, extreme care should be used because it also affects tool entry and exit clearance.

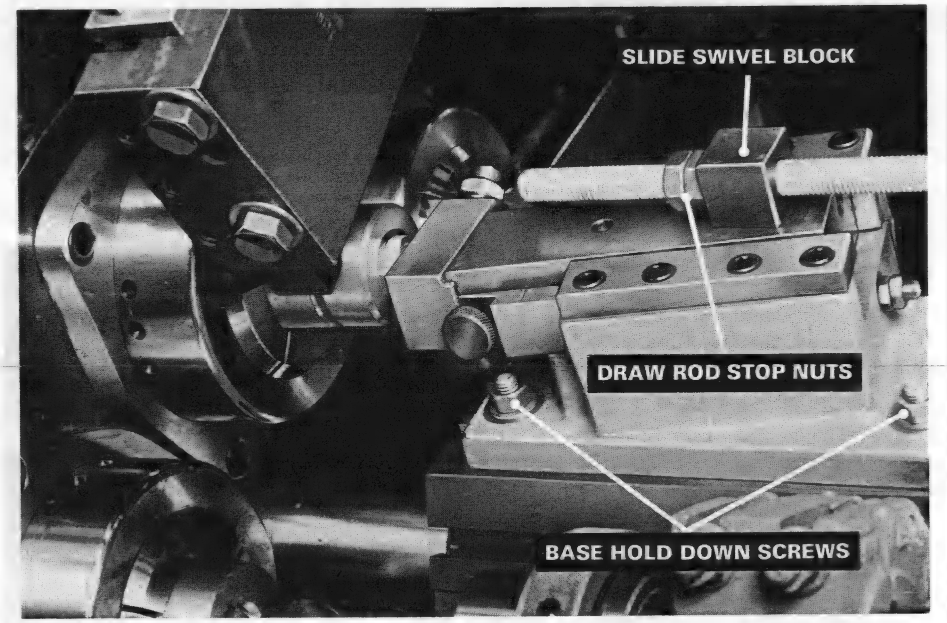
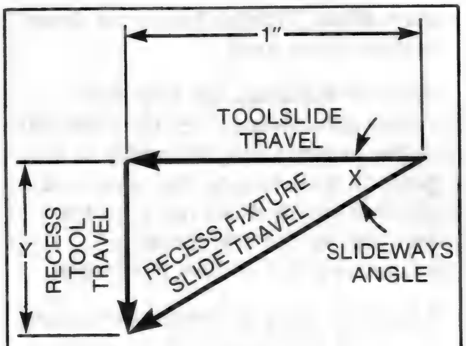


Fig. D-84. Draw rod stop nuts should contact the slide swivel block when the tool is full forward.



SLIDEWAYS ANGLE (X)	RECESS TOOL TRAVEL (Y)
10°	0.17"
15°	0.26"

Fig. D-85. Recessing tool travel is determined by angle of base slideways.

22. Set Fourth Position Tools

The fourth position operation on the Tooling Setup Chart (Fig. D-2) is to shave the part all over.

The first test part may be undersize due to the settings of the first position tools. (Step 19, section D, page 40) Do not perform this operation until a test bar is in position with the proper shaving stock (.008 inch over finish diameter).

22A. Set Cross Slide Tool

Run the machine so that the new test bar indexes to the fourth position.

> NOTE: Any time during setup that the machine is indexed, be sure the retracted tools clear both the indexing work piece and the *stock stop* in its furthest advanced position.

Continue to run the machine until the end toolslide guide bracket just contacts the end toolslide stop nuts. (Refer to Fig. D-69) Stop the machine at that point. Loosen the *locking screws* of the fourth position *cross slide.* (Refer to Fig. D-80) Use the cross slide adjusting screw to move the *cross slide* to its full back position. Fully back off the *cross slide stop screw* and lock in place.

The shaving tool must be positioned in the shaving fixture so its cutting edge is in line with the center of the roll. This is accomplished by clamping the shaving tool in the shaving fixture so the cutting edge is in line with the face of the fixture (use a straightedge). (Fig. D-86)

> NOTE: When the shaving tool is equipped with a backup set screw, use the set screw to establish the position of the tool's cutting edge when the set screw is bottomed in the fixture.

Mount the *roll block* on the shaving fixture. Using the *roll block adjusting screw,* adjust the position of the *roll block* (Fig. D-87) so the distance between the *roll* and the cutting edge of the shaving tool is exactly the same as the finished size of the part as indicated on the part drawing.

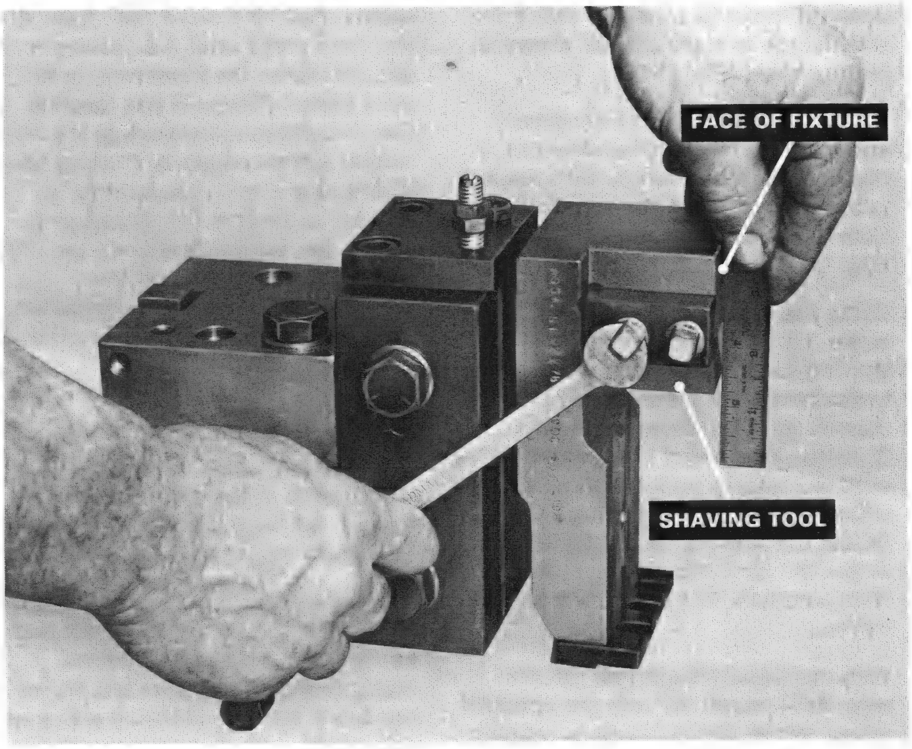


Fig. D-86. Use straightedge to line cutting edge with face of shaving fixture.

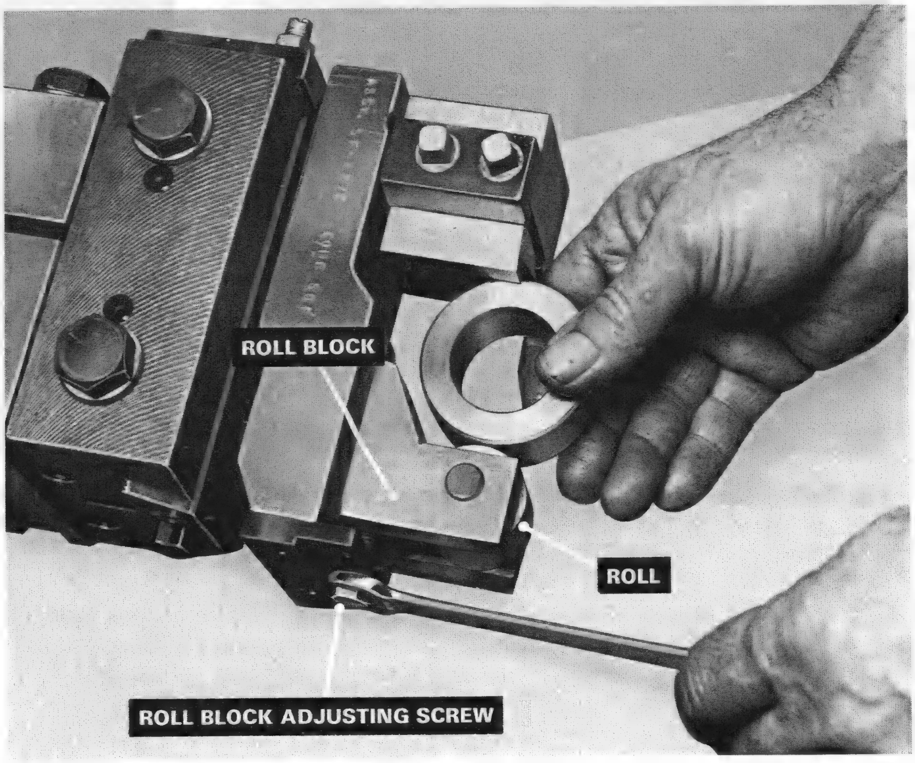


Fig. D-87. Adjust roll block to finished size of part.

Back off the *stop screw* so that the *slide* is free to travel its full distance in the *shank.* (Fig. D-88)

Mount the assembled shaving tool and fixture on the *cross slide* and position the tool laterally with respect to the groove cut in the work piece. Clamp the shaving fixture in place. (Fig. D-88)

Using the *cross slide adjusting screw,* move the shaving tool, shaving fixture and *cross slide* toward the work piece slowly until the roll contacts the work piece. Continue advancing the *cross slide* until the cutting tool is drawn to within 1/32 inch of the work piece. Adjust the shaving fixture *slide stop screw "A"* until it bottoms on the slide, and lock it in place with the *jam nut.*

With the feed disengaged, run the main drive motor so only the spindles rotate. While the bar stock is rotating, use the cross slide adjusting screw to slowly move the *cross slide* toward the work piece until the *shaving tool* and *roll* reach the centerline of the work piece. (The tool has reached the centerline of the work piece when further advancement of the tool fails to produce any chips. A mirror is helpful to observe the chips being cut as the tool is advanced.) Limit the travel of the tool beyond the centerline to the absolute minimum. (Fig. D-89)

Tighten the *cross slide locking screws* in place.

> **CAUTION: Before proceeding, check float of the *slide* in the *shank* to be sure the *slide* does not bottom against either plate.**

Jog the machine to be sure the work piece clears the shaving fixture and tool when the machine indexes. Measure OD of test part and adjust *roll block* with its *adjusting screw* as necessary.

23. Set Fifth Position Tools

The fifth position operations include reaming the hole and cutting off the finished part.

23A. Set End Toolslide Tool

Run the machine so the test bar indexes to the fifth position. Stop the machine with end toolslide fully back.

> NOTE: Any time during setup that the machine is indexed, be sure the retracted tools clear both the indexing work piece and the *stock stop* in its furthest advanced position.

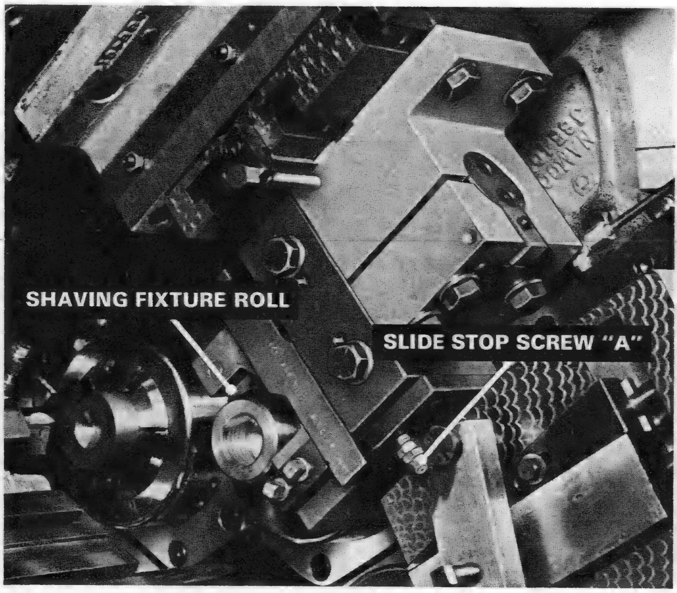


Fig. D-88. Mount shaving tool and fixture on cross slide.

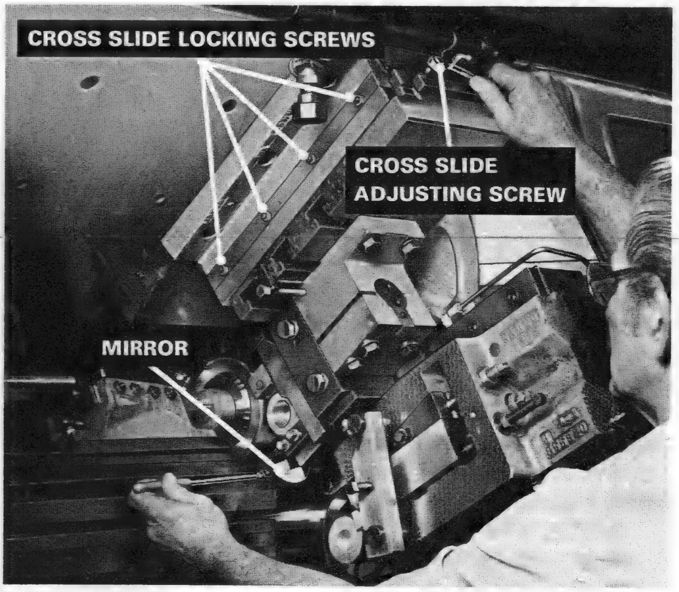


Fig. D-89. Move cross slide forward until shaving tool reaches centerline of work piece.

Mount the reaming cam set on the *die slide drum,* timing the low point of the reaming cam to coincide with the low point of the end toolslide cam. (Fig. D-90) This permits the reaming cam to retract the reamer before the high point of the end toolslide cam is reached, preventing the part from being cut off while the reamer is still in the hole.

With the *end toolslide* fully back, mount the accelerated reaming attachment. (Fig. D-91) Install the *lever pivot pin* in the proper holes in the *lever* and *lever bracket* to obtain the desired ratio (when more than one ratio is available).

> NOTE: Refer to the "Specifications and Principal Dimensions" pages of the *Acme-Gridley Multiple Spindle Bar Machine Manual Supplement* for available lever ratios.

In the example, this is the center hole to obtain a 1 to 1 ratio.

Mount the floating toolholder and reamer into the *reaming attachment spindle.*

Jog the machine to low point of the *reaming cam* while checking that the reamer does not hit the test bar or that the end toolslide toolholder does not interfere with the reaming attachment linkage. Adjust the *reaming attachment linkage* to position the end of the reamer just short of the face of the work piece. (Fig. D-92) Lock the *reaming attachment linkage* in place.

Jog or run the machine slowly to high point of *reaming cam,* making sure that reamer does not hit the bottom of the hole in the test bar. Reamer will now have made the first test cut. Continue to jog or run the machine slowly to high point of *end toolslide cam* while checking that the retracting reaming spindle does not interfere with or pull out of the toolslide toolholder. Crank or jog the machine in reverse to fully retract the *end toolslide* while checking to assure that the toolslide toolholder does not interfere with the reaming attachment linkage. Check the cut and adjust the reamer as necessary.

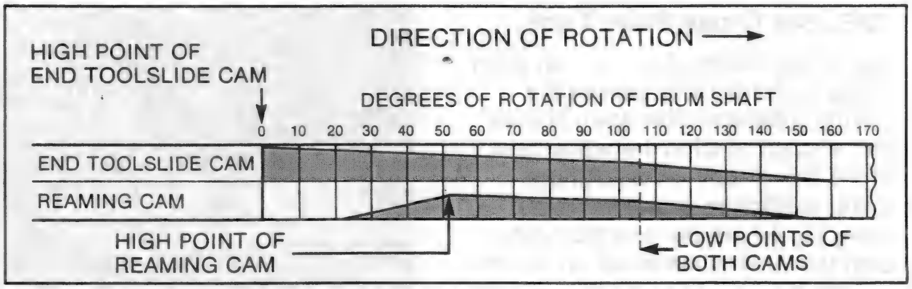

HIGH POINT OF END TOOLSLIDE CAM
DIRECTION OF ROTATION →
DEGREES OF ROTATION OF DRUM SHAFT
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170
END TOOLSLIDE CAM
REAMING CAM
HIGH POINT OF REAMING CAM
LOW POINTS OF BOTH CAMS

Fig. D-90. Time low point of reaming cam with low point of end toolslide cam.

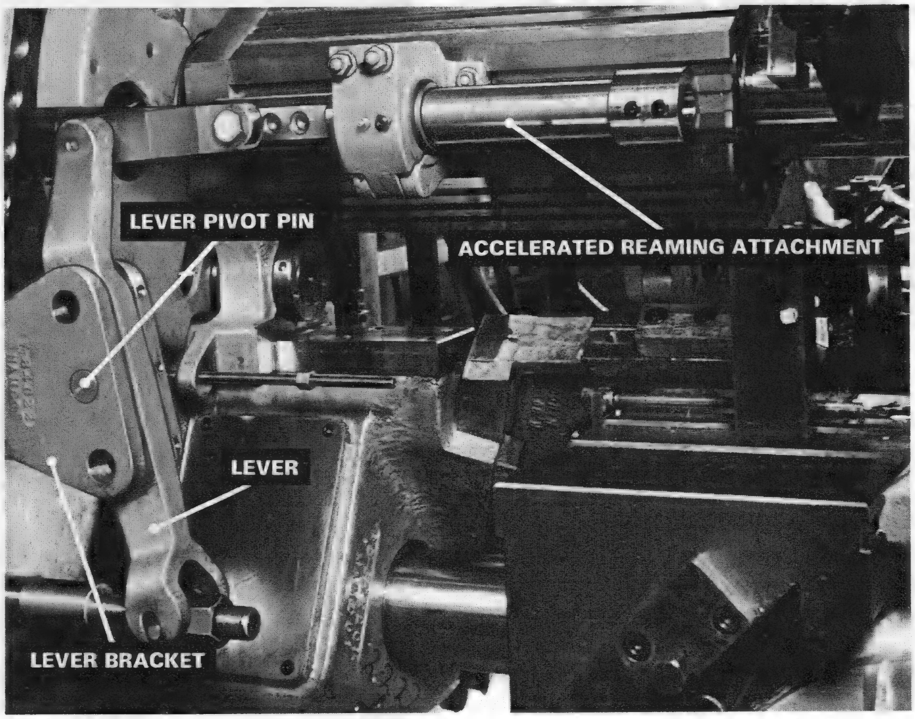

LEVER PIVOT PIN
ACCELERATED REAMING ATTACHMENT
LEVER
LEVER BRACKET

Fig. D-91. Mount accelerated reaming attachment.

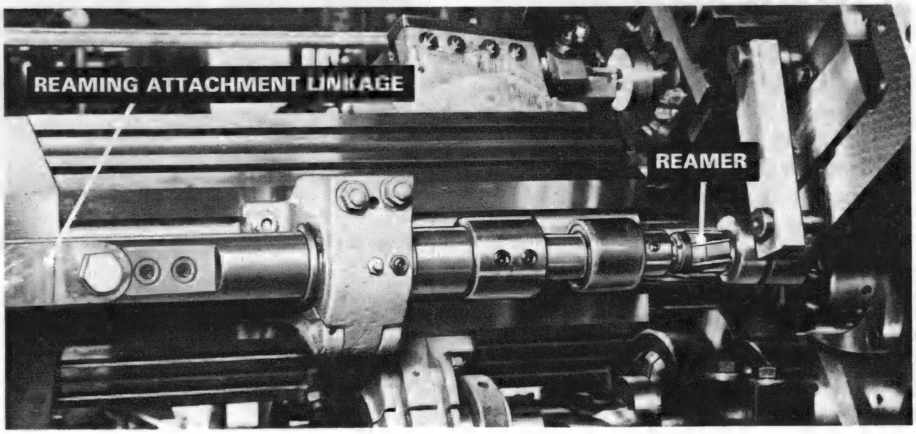

REAMING ATTACHMENT LINKAGE
REAMER

Fig. D-92. Position end of reamer just short of face of work piece.

23B. Set Cross Slide Tool

Jog or run the machine to high point of the toolslide cam. Loosen the *cutoff toolholder hold down screws* just enough to allow for adjustment of the cutoff toolholder. Using the *cutoff toolholder adjusting screw,* move the cutoff tool and toolholder until the work piece is cut off and the ring on the bar stock is removed. (Fig. D-93) Clamp the cutoff toolholder in place.

24. Install Coolant Lines

Install coolant piping to each tool in each position. Position the nozzles to direct coolant flow directly on cutting tools. (Figs. D-94 and 95) Where possible, do not direct coolant flow into work spindles. In some cases, it may be advisable to install coolant lines as each tool is set.

25. Make Tool Adjustments

Run the machine to index the test bar to the sixth position. Manually feed out a test part to the *stock stop.* (See Step 15, section D, page 35.)

Complete the machining operations thru both the sixth position and the first position. As soon as the first position operations are complete, stop the machine at high point. Crank or jog the machine in reverse to fully retract the *end toolslide.* Measure the OD of the part and note if the diameter is correct to allow stock for the shaving operation. (In the example the desired diameter should be approximately 0.008 inch over the finished part size [2.400/2.398] to allow stock for shaving operation.) Adjust the form tool as necessary. Continue machining the part thru the cutoff operation (fifth position). As part is being reamed, make certain that reamer is extracted before part is cut off.

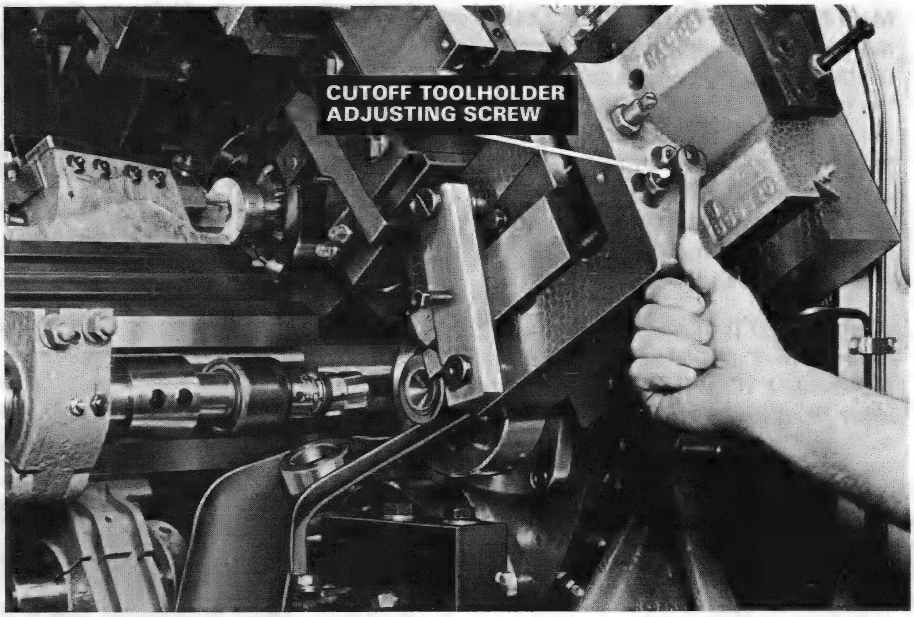


Fig. D-93. Use cutoff toolholder adjusting screw to move the cutoff tool.

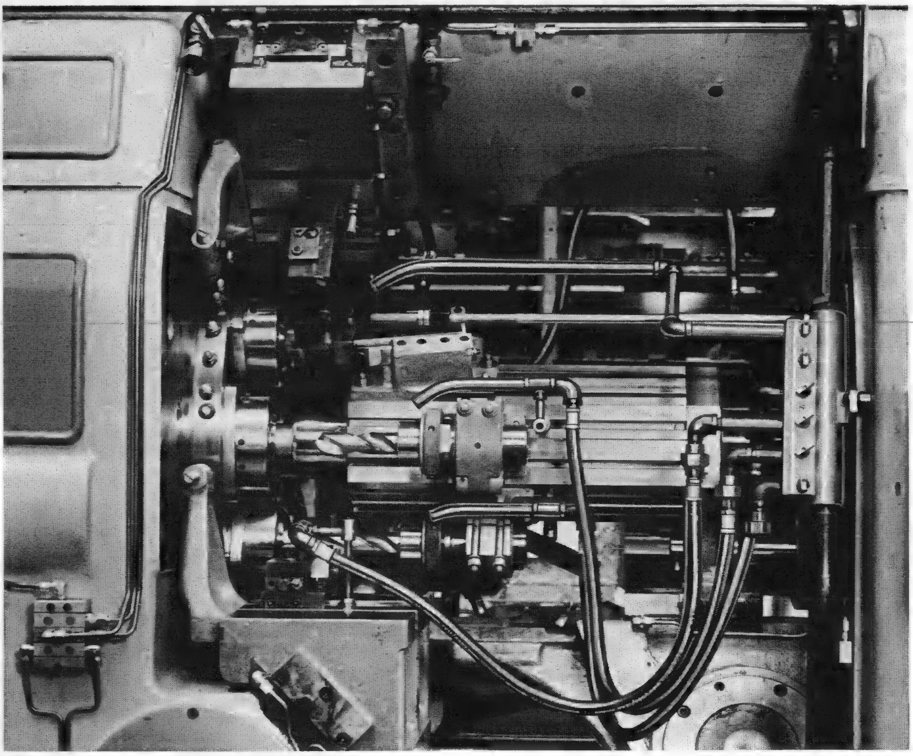


Fig. D-94. Coolant lines on front of machine.

Machine a few more test pieces checking all dimensions until all the dimensions are as specified on the part drawing. Adjust the tools as necessary. (Fig. D-96)

26. Install Work Chute

Use work chute from previous job or install a new work chute as needed.

27. Make Final Adjustments

Replace *chuck opening cam* and remove stop block used in Step 6 to cancel the bar stock feeding action.

Before proceeding to run production, it is advisable to again recheck all critical settings as described in Step 4E, section D, page 19.

Run machine to make two or three test parts on each spindle. Check automatic stock feed out to assure only minimum stock for facing. Mark each part with its spindle number.

Check all dimensions on each test part. If any one dimension varies from spindle to spindle, see Troubleshooting section of this handbook for corrective procedure.

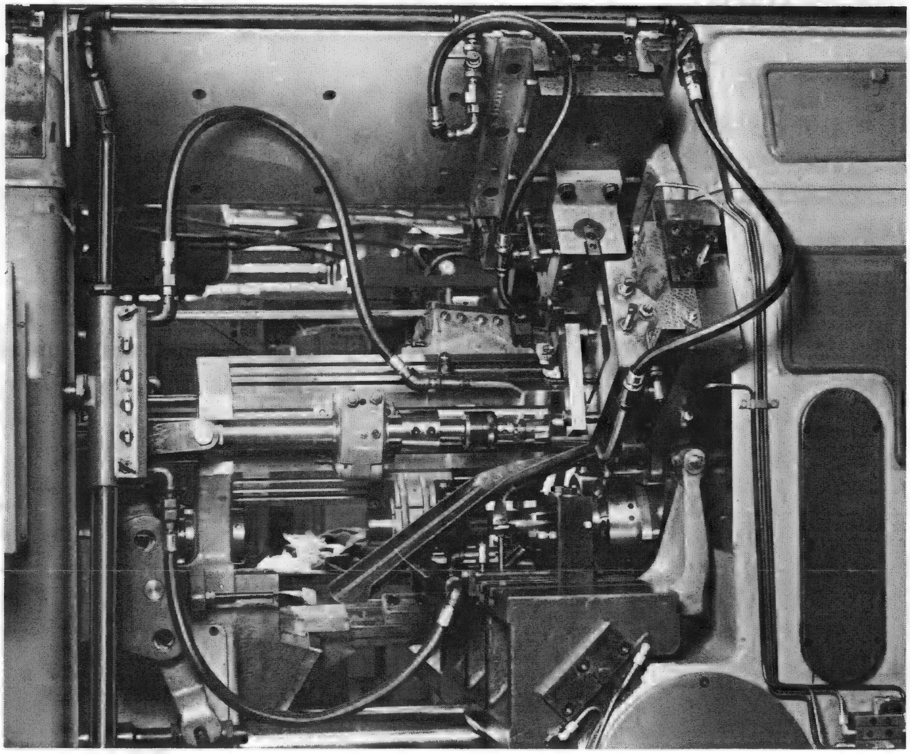


Fig. D-95. Coolant lines and work chute on rear of machine.

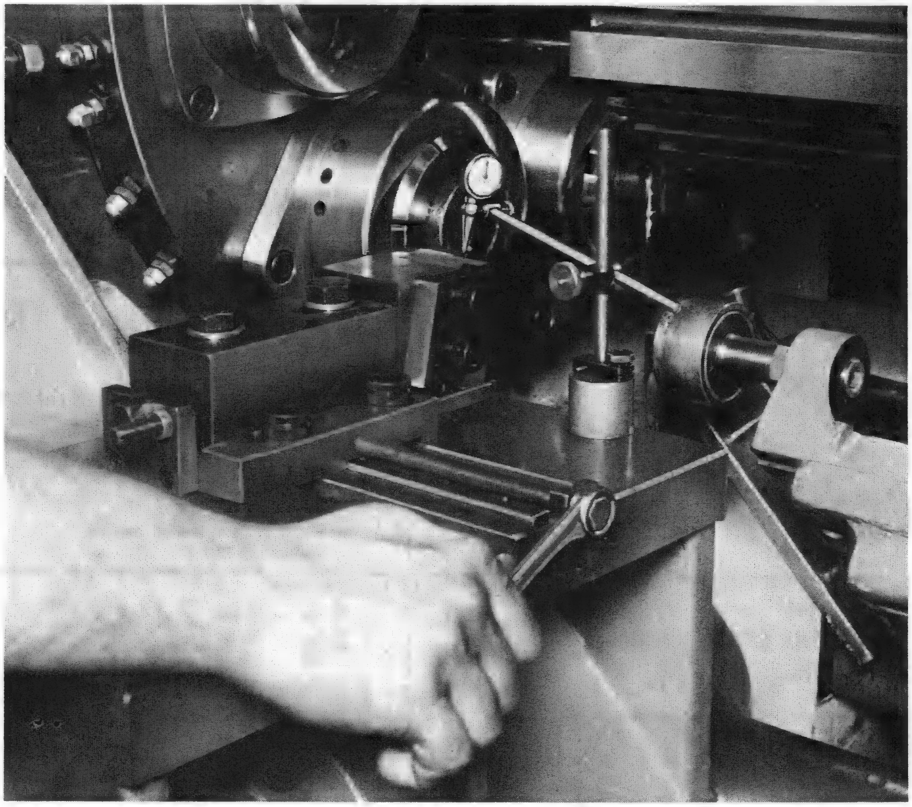
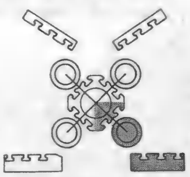
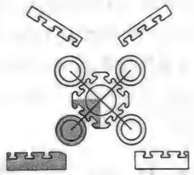
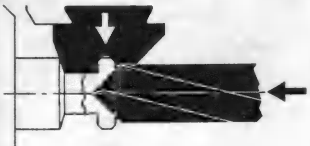
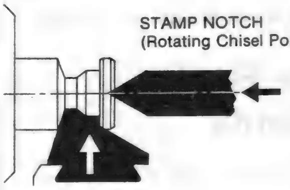
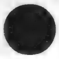
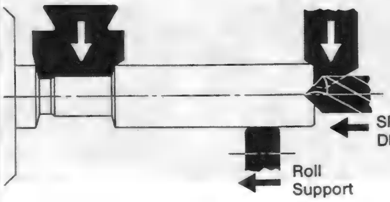
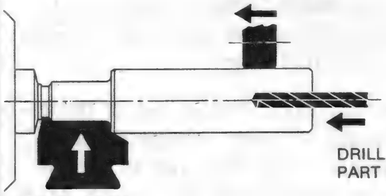
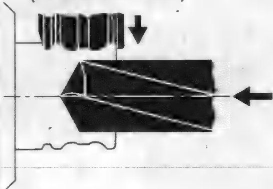
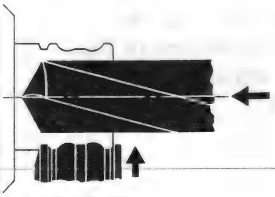
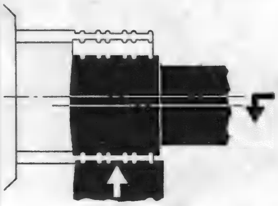
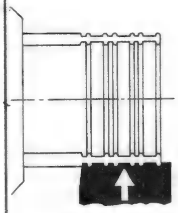
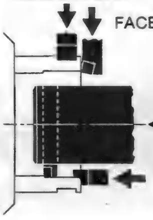
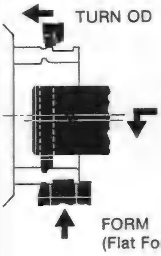
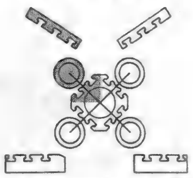
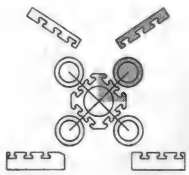
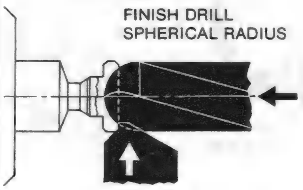
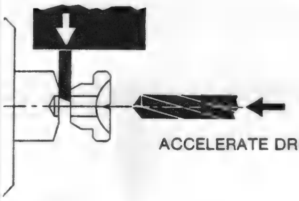
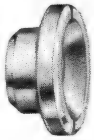
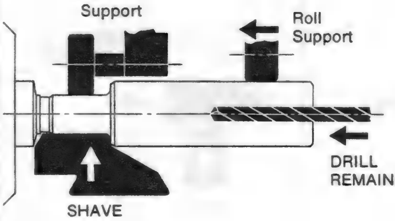
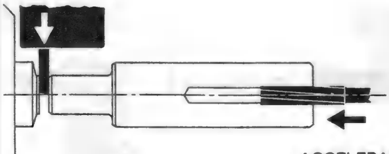
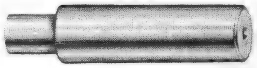
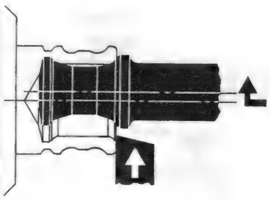
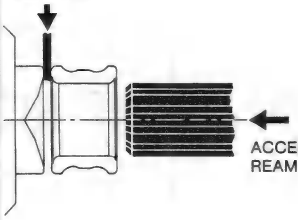
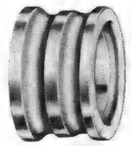
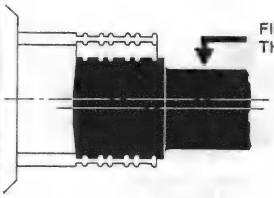
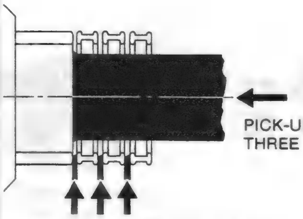
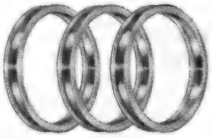
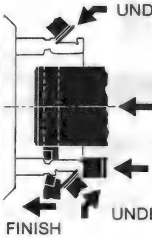
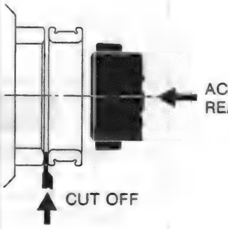
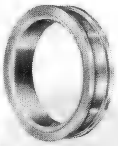


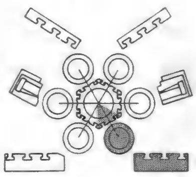
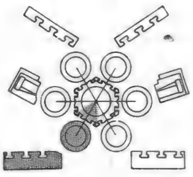
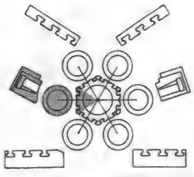
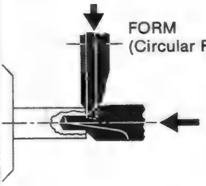
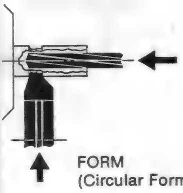
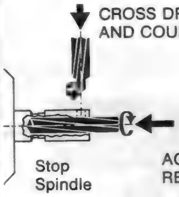
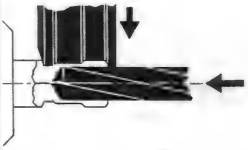
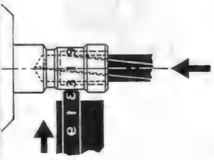
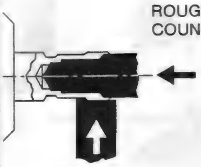
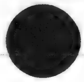
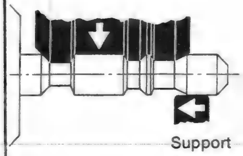
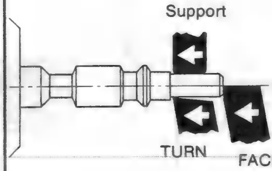
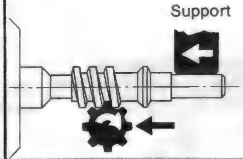
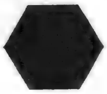
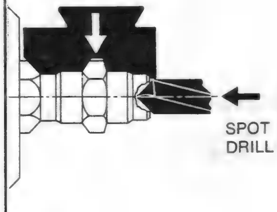
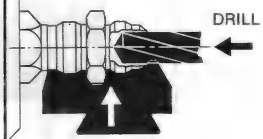
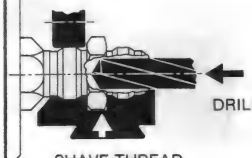
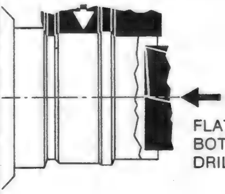
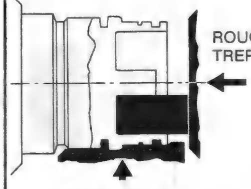
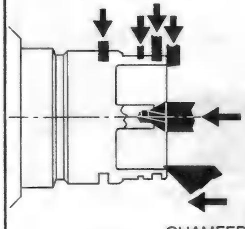
Fig. D-96. Make final tool adjustments. Using a dial indicator can often be of help.

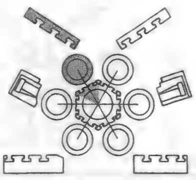
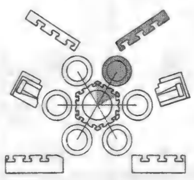
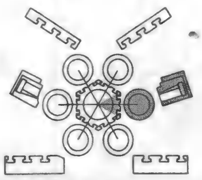
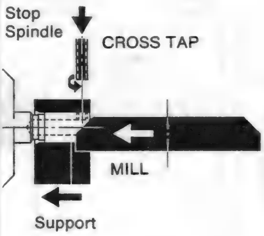
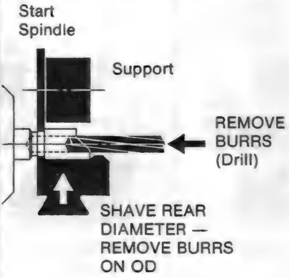
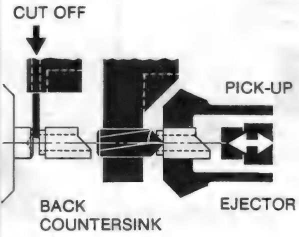
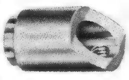
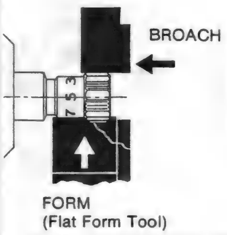
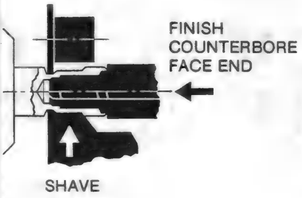
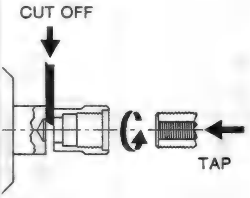
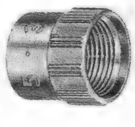
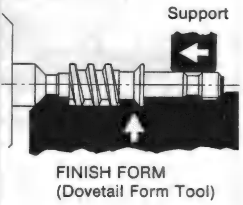
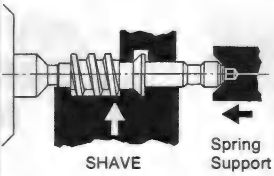
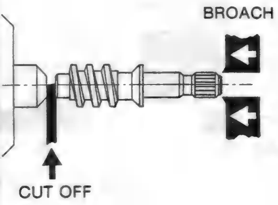
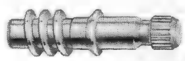
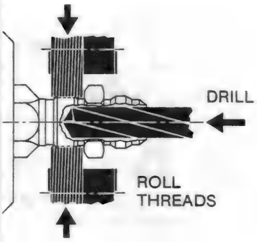
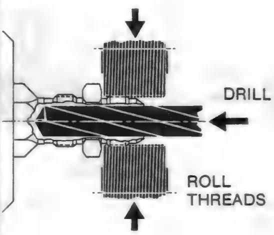
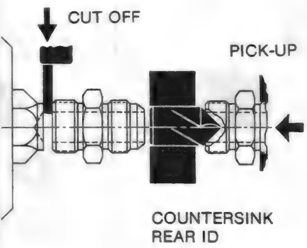
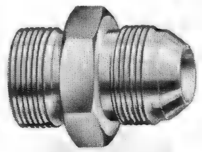
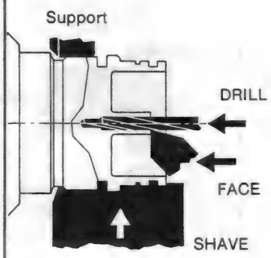
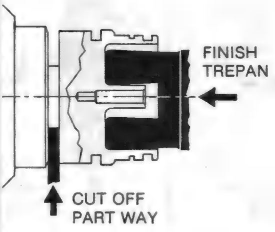
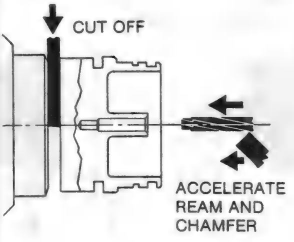
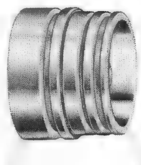
Typical Example Parts (4 spindle)

SPECIFICATIONS MACHINE SIZE MATERIAL USED STOCK SIZE - DIA.	POSITION 4 	POSITION 1 
1" RA-4 C-1120 COLD DRAWN STEEL ⅝" ROUND	 ROUGH FORM (Dovetail Form Tool) SPOT DRILL	 STAMP NOTCH (Rotating Chisel Point) FINISH FORM (Dovetail Form Tool)
1" RA-4 C-1120 COLD DRAWN STEEL $^{49}/_{64}$" ROUND 	 ROUGH FORM (Dovetail Form Tool) FACE AND CHAMFER (Flat Form Tool) SPOT DRILL Roll Support	 Roll Support DRILL PART WAY FINISH FORM (Dovetail Form Tool)
2" RAS-4 52100 HOT ROLLED STEEL $1^{13}/_{32}$" ROUND	 ROUGH FORM (Circular Form Tool) DRILL PART WAY	 DRILL REMAINDER FINISH FORM (Circular Form Tool)
3½" RB-4 C-1118 COLD DRAWN STEEL TUBING 2.343" OD x $1^{15}/_{16}$" ID	 ROUGH RECESS THREE PIECES ROUGH FORM THREE PIECES (Dovetail Form Tool)	 FINISH FORM THREE PIECES (Dovetail Form Tool)
7¾" RB-4 SAE 52100 STEEL TUBING 7.110"/7.080" OD x 5⅜" ID	 ROUGH FORM FACE END ROUGH BORE ID FORM FRONT INSIDE RADIUS	 TURN OD RECESS FROM INSIDE RADIUS FORM (Flat Form Tool)

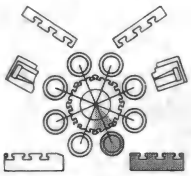
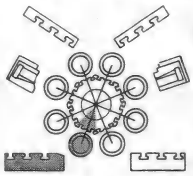
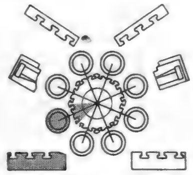
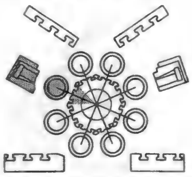
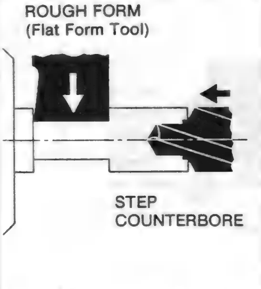
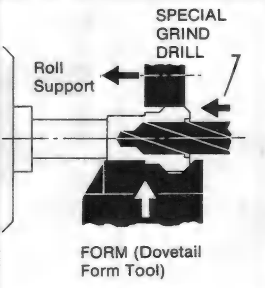
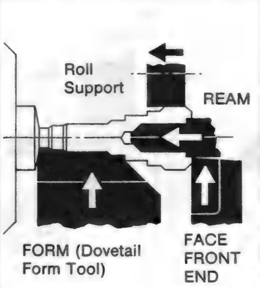
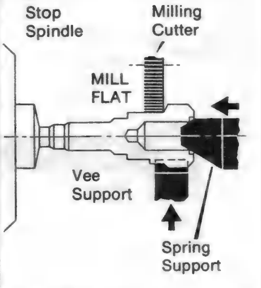
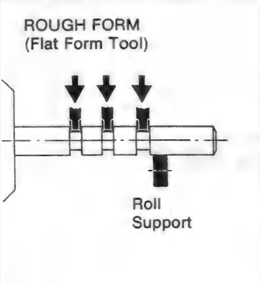
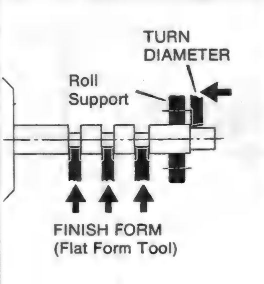
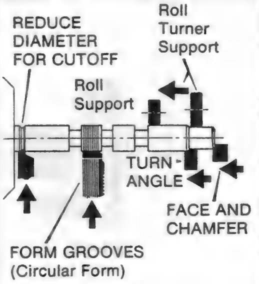
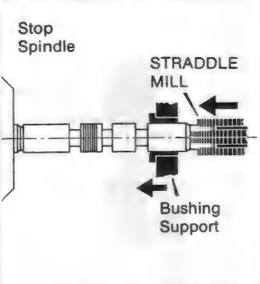
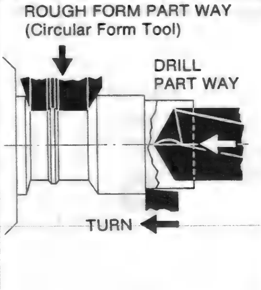
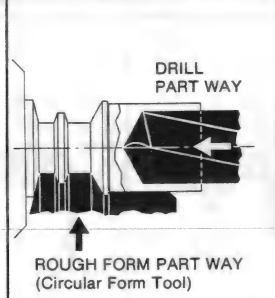
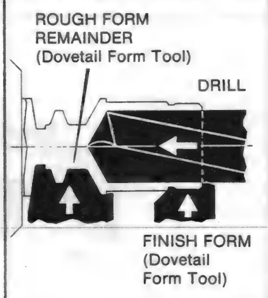
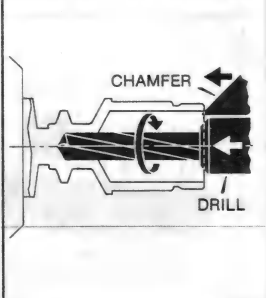
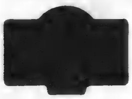
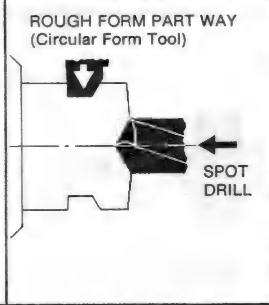
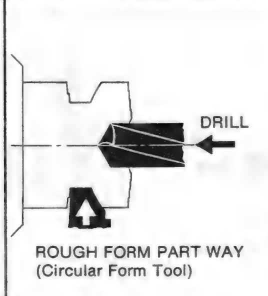
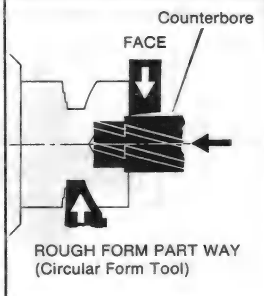
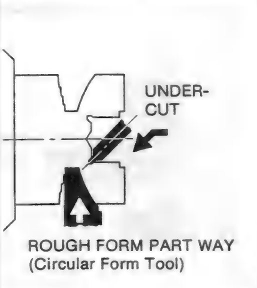
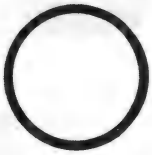
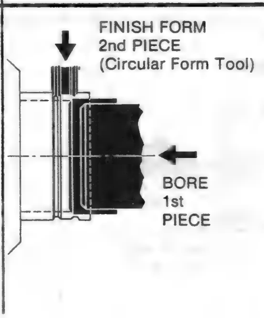
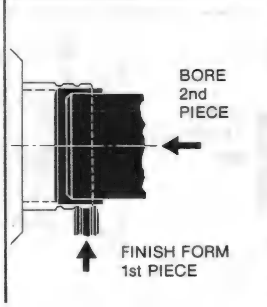
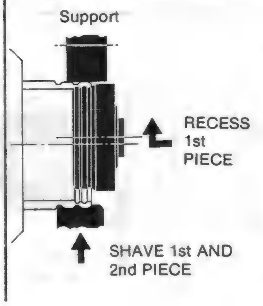
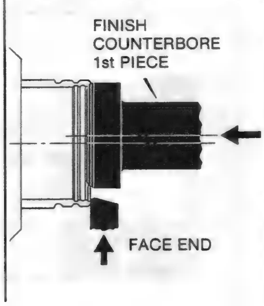
POSITION 2	POSITION 3	FINISHED PRODUCT
		TOTAL OPERATIONS TIME PER PIECE
 FINISH DRILL SPHERICAL RADIUS FINISH FACE, CHAMFER (Flat Form Tool)	 CUT OFF ACCELERATE DRILL	 (actual size) 8 OPERATIONS 10½ SECONDS
 Roll Support Roll Support DRILL REMAINDER SHAVE	 CUT OFF ACCELERATE REAM	 (⅜ actual size) 9 OPERATIONS 25½ SECONDS
 RECESS FORM INSIDE FACE END	 CUT OFF ACCELERATE REAM	 (½ actual size) 8 OPERATIONS 28 SECONDS
 FINISH RECESS THREE PIECES	 PICK-UP THREE PIECES CUT OFF THREE PIECES	 (¼ actual size) 8 OPERATIONS 40 SECONDS (3 pcs)
 UNDERCUT FINISH BORE FINISH FACE UNDERCUT FINISH TURN	 ACCELERATE REAM CUT OFF	 (¹⁄₁₀ actual size) 13 OPERATIONS 78 SECONDS

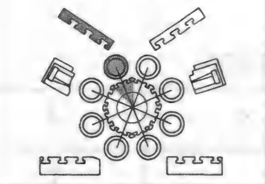
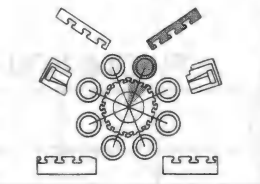
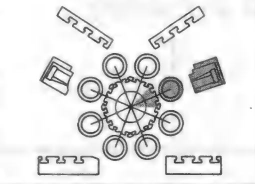
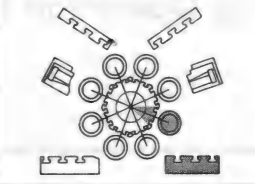
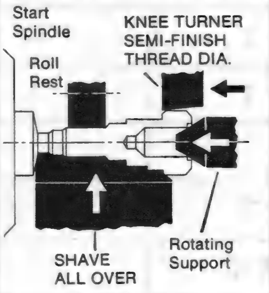
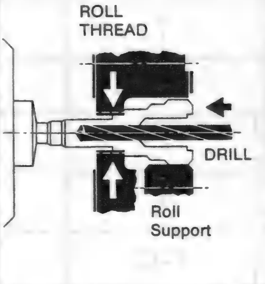
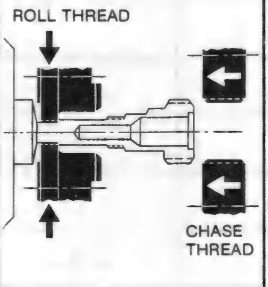
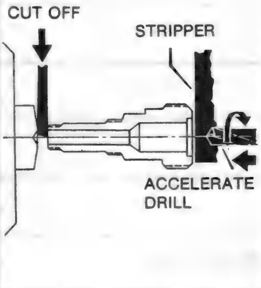
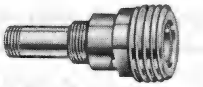
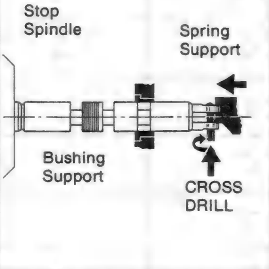
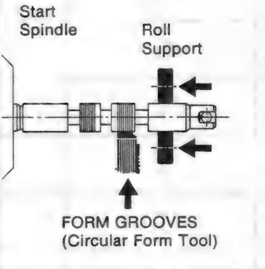
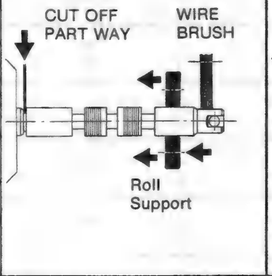
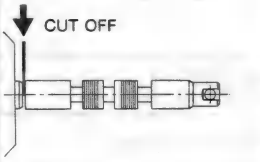
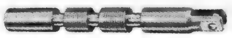
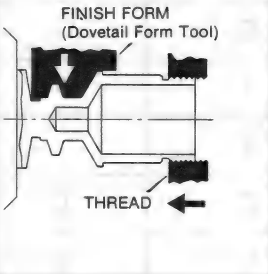
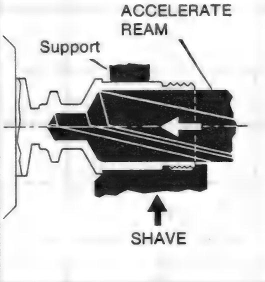
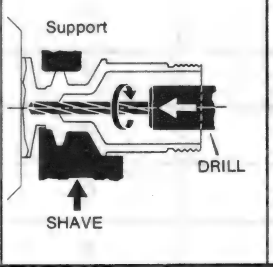
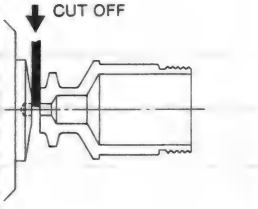
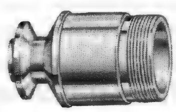
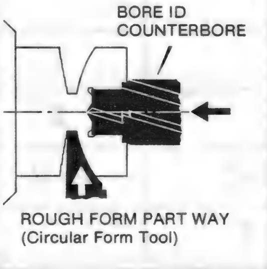
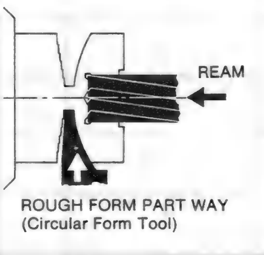
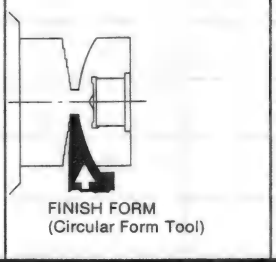
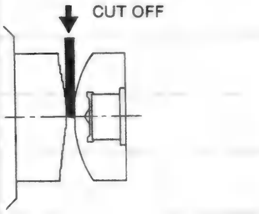
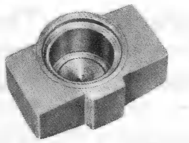
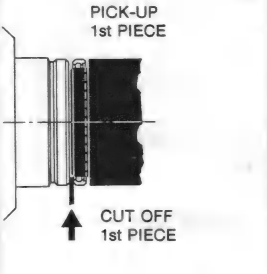
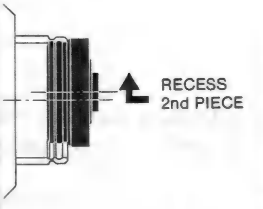
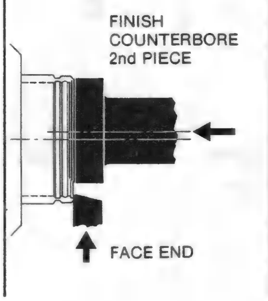
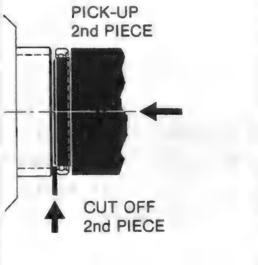
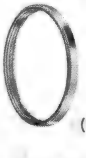
Typical Example Parts (6 spindle)

SPECIFICATIONS MACHINE SIZE MATERIAL USED STOCK SIZE - DIA.	POSITION 6 	POSITION 1 	POSITION 2 
7⁄16″ RA-6 AISI 1211 COLD DRAWN STEEL 9⁄32″ ROUND 	 FORM (Circular Form Tool) CENTER DRILL	 DRILL FORM (Circular Form Tool)	 CROSS DRILL AND COUNTERSINK Stop Spindle ACCELERATE REAM
9⁄16″ RA-6 #72 FREE CUTTING BRASS 17⁄32″ ROUND 	FORM (Circular Form Tool)  DRILL	 DRILL STENCIL	 ROUGH COUNTERBORE KNURL
1¼″ RA-6 AISI 1211 COLD DRAWN STEEL ½″ ROUND 	ROUGH FORM (Circular Form Tool)  Support	 Support TURN FACE	 Support GENERATE WORM
2″ RB-6 AISI 1211 COLD DRAWN STEEL 1¼″ HEX 	ROUGH FORM (Dovetail Form Tool)  SPOT DRILL	 DRILL FINISH FORM (Dovetail Form Tool)	 Roll Support DRILL SHAVE THREAD DIAMETERS
3½″ RB-6 C-1117 COLD DRAWN STEEL 2¹⁵⁄₁₆″ ROUND 	ROUGH FORM (Circular Form Tool)  FLAT BOTTOM DRILL	 ROUGH TREPAN ROUGH FORM (Dovetail Form Tool)	FORM GROOVES  CENTER DRILL CHAMFER

POSITION 3	**POSITION 4**	**POSITION 5**	**FINISHED PRODUCT**
			TOTAL OPERATIONS TIME PER PIECE
 Stop Spindle CROSS TAP MILL Support	 Start Spindle Support REMOVE BURRS (Drill) SHAVE REAR DIAMETER — REMOVE BURRS ON OD	 CUT OFF PICK-UP BACK COUNTERSINK EJECTOR	 (actual size) 13 OPERATIONS 6 SECONDS
 BROACH 7 5 3 FORM (Flat Form Tool)	 FINISH COUNTERBORE FACE END SHAVE		 (actual size) 12.OPERATIONS 4½ SECONDS
 Support FINISH FORM (Dovetail Form Tool)	 SHAVE Spring Support	 BROACH CUT OFF	 (½ actual size) 9 OPERATIONS 6 SECONDS
 DRILL ROLL THREADS	 DRILL ROLL THREADS	 CUT OFF PICK-UP COUNTERSINK REAR ID	 (½ actual size) 13 OPERATIONS 27 SECONDS
 Support DRILL FACE SHAVE	 FINISH TREPAN CUT OFF PART WAY	 CUT OFF ACCELERATE REAM AND CHAMFER	 (¼ actual size) 18 OPERATIONS 40 SECONDS

Typical Example Parts (8 spindle)

SPECIFICATIONS MACHINE SIZE MATERIAL USED STOCK SIZE - DIA.	POSITION 8	POSITION 1	POSITION 2	POSITION 3
				
1¼″ RB-8 ALUMINUM 13/16″ ROUND 	 ROUGH FORM (Flat Form Tool) STEP COUNTERBORE	 SPECIAL GRIND DRILL Roll Support FORM (Dovetail Form Tool)	 Roll Support REAM FORM (Dovetail Form Tool) FACE FRONT END	 Stop Spindle Milling Cutter MILL FLAT Vee Support Spring Support
1⅝″ RB-8 C-1141 LEADED GROUND STOCK .885″ x .888″ ROUND 	 ROUGH FORM (Flat Form Tool) Roll Support	 TURN DIAMETER Roll Support FINISH FORM (Flat Form Tool)	 REDUCE DIAMETER FOR CUTOFF Roll Turner Support Roll Support TURN - ANGLE FACE AND CHAMFER FORM GROOVES (Circular Form)	 Stop Spindle STRADDLE MILL Bushing Support
2⅝″ RB-8 C-1137 COLD DRAWN STEEL 1⅞″ ROUND 	 ROUGH FORM PART WAY (Circular Form Tool) DRILL PART WAY TURN	 DRILL PART WAY ROUGH FORM PART WAY (Circular Form Tool)	 ROUGH FORM REMAINDER (Dovetail Form Tool) DRILL FINISH FORM (Dovetail Form Tool)	 CHAMFER DRILL
3½″ RB-8 C-1118 STEEL EXTRUDED 	 ROUGH FORM PART WAY (Circular Form Tool) SPOT DRILL	 DRILL ROUGH FORM PART WAY (Circular Form Tool)	 Counterbore FACE ROUGH FORM PART WAY (Circular Form Tool)	 UNDER-CUT ROUGH FORM PART WAY (Circular Form Tool)
4″ RB-8 C-1118 STEEL TUBING 3.434″ OD x 3.004″ ID 	 FINISH FORM 2nd PIECE (Circular Form Tool) BORE 1st PIECE	 BORE 2nd PIECE FINISH FORM 1st PIECE	 Support RECESS 1st PIECE SHAVE 1st AND 2nd PIECE	 FINISH COUNTERBORE 1st PIECE FACE END

POSITION 4	POSITION 5	POSITION 6	POSITION 7	FINISHED PRODUCT
				TOTAL OPERATIONS TIME PER PIECE
 Start Spindle Roll Rest KNEE TURNER SEMI-FINISH THREAD DIA. SHAVE ALL OVER Rotating Support	 ROLL THREAD DRILL Roll Support	 ROLL THREAD CHASE THREAD	 CUT OFF STRIPPER ACCELERATE DRILL	(½ actual size) 19 OPERATIONS 5.6 SECONDS
 Stop Spindle Spring Support Bushing Support CROSS DRILL	 Start Spindle Roll Support FORM GROOVES (Circular Form Tool)	 CUT OFF PART WAY WIRE BRUSH Roll Support		(⅛ actual size) 18 OPERATIONS 34 SECONDS
 FINISH FORM (Dovetail Form Tool) THREAD	 ACCELERATE REAM Support SHAVE	 Support DRILL SHAVE		(¼ actual size) 17 OPERATIONS 30 SECONDS
 BORE ID COUNTERBORE ROUGH FORM PART WAY (Circular Form Tool)	 REAM ROUGH FORM PART WAY (Circular Form Tool)	 FINISH FORM (Circular Form Tool)		(¼ actual size) 14 OPERATIONS 39 SECONDS
 PICK-UP 1st PIECE CUT OFF 1st PIECE	 RECESS 2nd PIECE	 FINISH COUNTERBORE 2nd PIECE FACE END	 PICK-UP 2nd PIECE CUT OFF 2nd PIECE	(⅛ actual size) 15 OPERATIONS 32 SECONDS (2 pcs)

Spindle Position vs Operation (4 spindle)

	SPINDLE POSITION			
OPERATION	1	2	3	4
Boring	T	T		T
Boring (Accelerated)		T	T	
Boring (Contour)		T	T	
Boring (Recess)		T		
Broaching	T	T	T	
Burnishing (Internal-External)	T-C	T-C	T-C	T
Chasing (Thread) (Single Point)	T-C	T-C	T-C	
Cutoff	C	C	C	C
Die Head (Threading) (Plain or Universal)		T	T	
Die Rolling (Raised Characters)	C	C	C	
Drilling	T	T	T	
Drilling (Accelerated)		T	T	
Drilling (Cross)①②	C	C	C	
Drilling (Eccentric)	T	T	T	T
Drilling (Rotated)	T	T	T	
Forming	C	C	C	C
Forming (Eccentric)	C	C	C	C
Generating (Thread)		C	C	
Generating (Worm)		C		C
Hobbing (Spline)①		C		C
Knurling	T-C	T-C	T-C	T-C
Milling (Contour)		T	T	
Milling (Cross)①②	C	C	C	

LEGEND:
T - operations possible from end toolslide
C - operations possible from cross slides
T-C - operations possible from end toolslide or cross slides

NOTES: ① Standard machine requires modification to perform this operation.

② Need spindle stopping mechanism.

OPERATION	SPINDLE POSITION 1	2	3	4
Milling (Hollow)		T	T	
Milling (Polygon)	C	T-C	T-C	C
Milling (Recess)		T	T	
Reaming	T	T	T	
Reaming (Accelerated)		T	T	
Recessing	T-C	T-C	T-C	
Recessing (Eccentric)		T	T	
Rolling (Thread)		T-C	T-C	
Sawing①②	T	T-C	T-C	
Shaving	C	C	C	
Skiving	C	C	C	C
Slotting	T	T	T	
Slotting (Cross)①②	C	C	C	
Spinning	T-C	T-C	T-C	
Stenciling (Depressed Characters)	T-C	T-C	T	
Swaging	T-C	T-C	T-C	
Tapping (Cross)①②	C	C	C	
Tapping (Threading)		T	T	
Tapping (Universal)		T	T	
Turning	T	T	T	T
Turning (Contour)	C	C	C	C
Turning (Eccentric)	T-C	T-C	T-C	T-C
Turning (Tracer)①	C	C	C	

Spindle Position vs Operation (6 spindle)

OPERATION	SPINDLE POSITION 1	2	3	4	5	6
Boring	T	T	T	T		T
Boring (Accelerated)		T	T	T	T	
Boring (Contour)		T	T	T		
Boring (Recess)		T	T	T		
Broaching	T	T	T	T		
Burnishing (Internal-External)	T	T-C	T-C	T-C	T	T
Chasing (Thread) (Single Point)	T-C	T-C	T-C	T-C		
Cutoff	C	C	C	C	C	C
Die Head (Threading) (Plain or Universal)		T	T	T	T	
Die Rolling (Raised Characters)	C	C	C	C		C
Drilling	T	T	T	T	T	T
Drilling (Accelerated)		T	T	T	T	
Drilling (Cross)①②	C	C	C	C		C
Drilling (Eccentric)	T	T	T	T		T
Drilling (Rotated)	T	T	T	T		T
Forming	C	C	C	C	C	C
Forming (Eccentric)	C	C	C	C		C
Generating (Thread)		C	C	C		
Generating (Worm)		C	C	C		
Hobbing (Spline)①		C	C	C		
Knurling	T-C	T-C	T-C	T-C		T-C
Milling (Contour)		T	T	T		
Milling (Cross)①②	C	C	C	C		

LEGEND:
T - operations possible from end toolslide
C - operations possible from cross slides
T-C - operations possible from end toolslide or cross slides

NOTES: ① Standard machine requires modification to perform this operation.

② Need spindle stopping mechanism.

OPERATION	SPINDLE POSITION 1	2	3	4	5	6
Milling (Hollow)		T	T	T	T	
Milling (Polygon)	C	T-C	T-C	T-C		
Milling (Recess)			T	T		
Reaming	T	T	T	T		
Reaming (Accelerated)		T	T	T	T	
Recessing	T-C	T-C	T-C	T-C		
Recessing (Eccentric)		T	T	T		
Rolling (Thread)		C	T-C	T-C	T	
Sawing①②	T	T-C	T-C	T-C		
Shaving	C	C	C	C		
Skiving	C	C	C	C		C
Slotting	T	T	T	T		
Slotting (Cross)①②	C	C	C	C		
Spinning	T-C	T-C	T-C	T-C		
Stenciling (Depressed Characters)	T-C	T-C	T-C	T-C	T	
Swaging	T-C	T-C	T-C	T-C		
Tapping (Cross)①②	C	C	C	C		
Tapping (Threading)		T	T	T	T	
Tapping (Universal)		T	T	T	T	
Turning	T	T	T	T		T
Turning (Contour)	C	C	C	C		C
Turning (Eccentric)	T-C	T-C	T-C	T-C		T-C
Turning (Tracer)①	C	C	C	C		C

Spindle Position vs Operation (8 spindle)

OPERATION	SPINDLE POSITION 1	2	3	4	5	6	7	8
Boring	T	T	T	T	T	T		T
Boring (Accelerated)			T	T	T	T	T	
Boring (Contour)			T	T	T	T		
Boring (Recess)			T	T	T	T		
Broaching		T	T	T	T	T	T	
Burnishing (Internal-External)		T-C	T-C	T-C	T-C	T-C	T-C	
Chasing (Thread) (Single Point)		C	C	C	C	C	C	
Cutoff	C	C	C	C	C	C	C	C
Die Head (Threading) (Plain or Universal)			T	T	T	T	T	
Die Rolling (Raised Characters)	C	C	C	C	C	C		
Drilling	T	T	T	T	T	T	T	T
Drilling (Accelerated)			T	T	T	T	T	
Drilling (Cross)①②	C	C	C	C	C	C		
Drilling (Eccentric)	T	T	T	T	T	T		
Drilling (Rotated)	T	T	T	T	T	T		
Forming	C	C	C	C	C	C	C	C
Forming (Eccentric)	C	C	C	C	C	C		
Generating (Thread)		C	C	C	C	C		
Generating (Worm)		C	C	C	C	C		
Hobbing (Spline)①		C	C	C	C	C		
Knurling	T-C	T-C	T-C	T-C	T-C	T-C		T-C
Milling (Contour)			T	T	T	T		
Milling (Cross)①②	C	C	C	C	C	C		

LEGEND:
T - operations possible from end toolslide
C - operations possible from cross slides
T-C - operations possible from end toolslide or cross slides

NOTES:
① Standard machine requires modification to perform this operation.

② Need spindle stopping mechanism.

OPERATION	SPINDLE POSITION							
	1	2	3	4	5	6	7	8
Milling (Hollow)			T	T	T	T	T	
Milling (Polygon)	C	T-C	T-C	T-C	T-C	T-C		
Milling (Recess)				T	T			
Reaming	T	T	T	T	T	T		T
Reaming (Accelerated)		T	T	T	T	T	T	
Recessing	T-C	T-C	T-C	T-C	T-C	T-C		
Recessing (Eccentric)			T	T	T	T		
Rolling (Thread)		C	T-C	T-C	T-C	T-C	T	
Sawing①②	T	T-C	T-C	T-C	T-C	T-C		
Shaving		C	C	C	C	C		
Skiving		C	C	C	C	C		C
Slotting		T	T	T	T	T		
Slotting (Cross)①②		C	C	C	C	C		
Spinning	T-C	T-C	T-C	T-C	T-C	T-C		
Stenciling (Depressed Characters)	T-C	T-C	T-C	T-C	T-C	T-C	T	
Swaging	T-C	T-C	T-C	T-C	T-C	T-C		
Tapping (Cross)①②		T	T	T	T	T		
Tapping (Threading)			T	T	T	T	T	
Tapping (Universal)			T	T	T	T	T	
Turning	T	T	T	T	T	T		T
Turning (Contour)	C	C	C	C	C	C		C
Turning (Eccentric)	T-C	T-C	T-C	T-C	T-C	T-C		T-C
Turning (Tracer)①	C	C	C	C	C	C		C

SECTION E: OPERATION
Table of Contents

Operator Controls 2
  Starting Procedure 3
  Hand Chucking 4
General Instructions 5
  Stock, Chucking and Collets 5
  Motor and Operating Levers 5
  Cams, Clutches and Brakes 5
  Tools, Toolholders and Gibs 6
  Lubricants and Coolants 6

OPERATION

Operator Controls

A typical Acme-Gridley Multiple Spindle Bar Machine is equipped with two operator control stations, one on the front side of the machine and the other on the rear side. (Figs. E-1 and E-2) Each station contains the necessary controls for station selection, main motor and feed. Controls for such auxiliary devices as the coolant pump and chip conveyor are normally provided on the rear station only. See section B, page 28, for a description of each control.

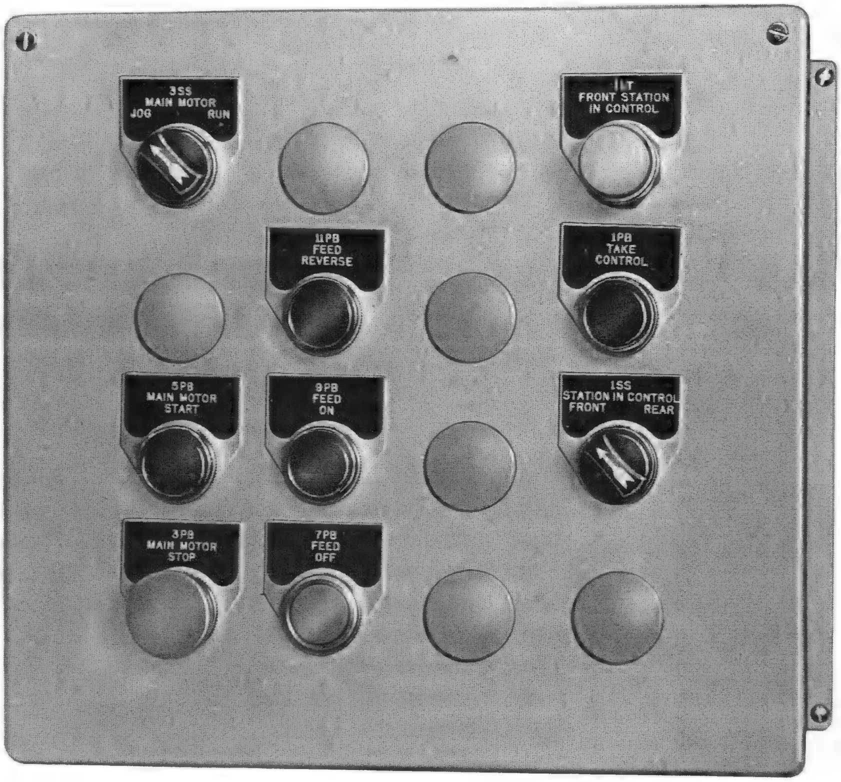

3SS MAIN MOTOR JOG RUN
1LT FRONT STATION IN CONTROL
11PB FEED REVERSE
1PB TAKE CONTROL
5PB MAIN MOTOR START
9PB FEED ON
1SS STATION IN CONTROL FRONT REAR
3PB MAIN MOTOR STOP
7PB FEED OFF

Fig. E-1. Front side control station.

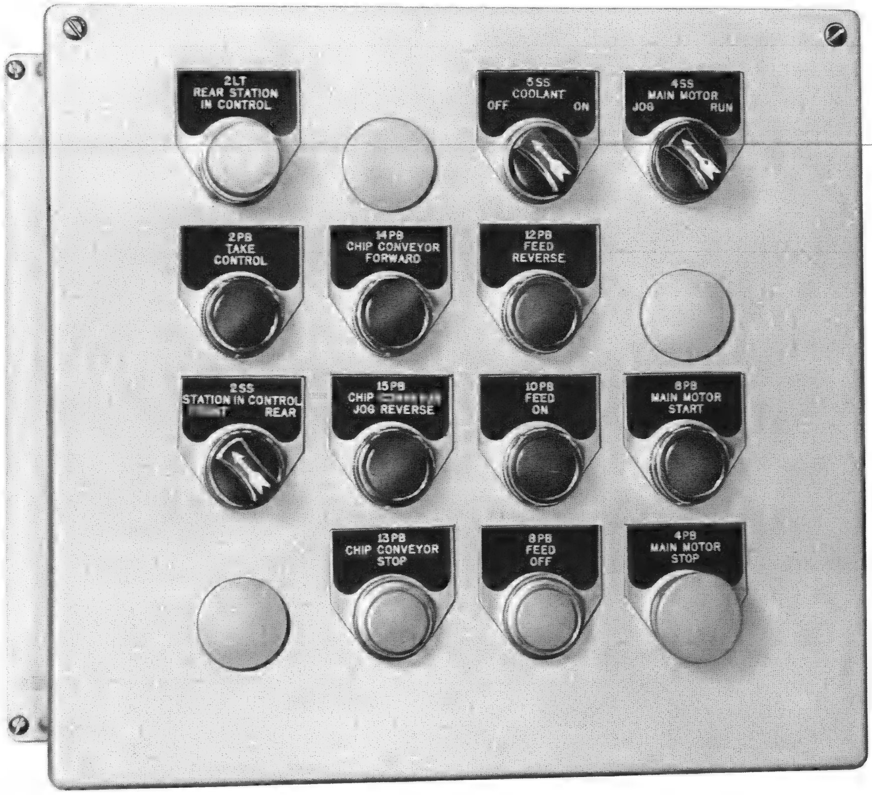

2LT REAR STATION IN CONTROL
5SS COOLANT OFF ON
4SS MAIN MOTOR JOG RUN
2PB TAKE CONTROL
14PB CHIP CONVEYOR FORWARD
12PB FEED REVERSE
2SS STATION IN CONTROL REAR
15PB CHIP JOG REVERSE
10PB FEED ON
6PB MAIN MOTOR START
13PB CHIP CONVEYOR STOP
8PB FEED OFF
4PB MAIN MOTOR STOP

Fig. E-2. Rear side control station.

Starting Procedure

1. Turn ON air supply. The design pressure is 60 PSI but in no case should the operating pressure exceed 80 PSI. If the machine is equipped with an air lockout valve, make sure it is OPEN.
2. Put main disconnect in OFF position. This disconnecting means is on the large electrical panel located at the motor end of the machine.
3. Select the station to be used (front or rear) to operate the machine by setting **both** STATION IN CONTROL selector switches at either FRONT or REAR. All MAIN MOTOR START, FEED ON and FEED REVERSE controls are inoperative until both selector switches are at the **same** setting and Step 4 is completed.
4. Press the TAKE CONTROL button on the selected station. This action causes the STATION IN CONTROL indicator to light and activates the MAIN MOTOR START, FEED ON and FEED REVERSE controls on the selected station only. These controls on the opposite station remain inoperative.
5. Starting at the station in control, set the MAIN MOTOR JOG/RUN selector switch to JOG. Then go to the opposite station and set its MAIN MOTOR JOG/RUN selector switch to RUN.
6. If the machine has a chip conveyor, press the CHIP CONVEYOR FORWARD button to start the conveyor motor. To reverse the conveyor (such as for cleaning), first stop the conveyor with the CHIP CONVEYOR STOP button and then press the CHIP CONVEYOR JOG REVERSE button. The conveyor will run in the reverse direction only while this button is held depressed.
7. If the machine has a coolant pump, set the COOLANT OFF/ON selector switch to ON. This, by itself, will not start the pump, but the pump will start whenever the main drive motor is turned ON.
8. At the station in control, press the FEED ON button to engage the feed clutch.

   NOTE: The hand crank must be removed before the feed forward or feed reverse clutches can be engaged.
9. At the station in control, press the MAIN MOTOR START button to start the main drive motor. The motor will run only while this button is held depressed at this time because the main motor selector switch is set at JOG (Step 5). It is good practice to jog the machine thru a complete cycle, particularly after a tooling and/or attachment change, to make sure everything operates properly and no interferences exist.

   NOTE: The feed can be engaged before starting the main motor **only** when the main motor selector switch is set at JOG.
10. When you are sure the machine is operating properly, set the MAIN MOTOR JOG/RUN selector switch at the station in control to RUN.
11. At the station in control, press the MAIN MOTOR START button. Hold this button depressed for a short time to allow the lubrication oil pressure to build up sufficiently to close the lubrication pressure switch and complete the main motor holding circuit.
12. At the station in control, press the FEED ON button to engage the feed clutch. The machine will now cycle continuously until the FEED OFF button is pressed. Except in an emergency, always press the FEED OFF button first and then press the MAIN MOTOR STOP button.

When it is desired to stop the machine, it is good practice to do so following an index of the spindle carrier with the collet closed and before the tools contact the work. Press the FEED OFF button first and then press the MAIN MOTOR STOP button.

The feed can be reversed only during the cutting part of the machine cycle and only when the MAIN MOTOR JOG/RUN selector switch is set at JOG. Start by stopping the feed (if not already stopped) with the FEED OFF button. Then press the FEED REVERSE button while jogging the main motor with the MAIN MOTOR START button.

NOTE: The hand crank must always be removed from the worm shaft before the feed reverse clutch can be engaged.

The chip conveyor can be stopped at any time by pressing the CHIP CONVEYOR STOP button.

The coolant pump can be stopped at any time by turning the COOLANT OFF/ON selector switch to OFF.

Hand Chucking

The hand chucking lever (Fig. E-3) is used to manually open and close the collet while changing collets, adjusting the collet grip, removing butt ends of stock, and reloading of the machine with new stock. It is located in the first position where these operations are normally performed.

Move the hand chucking lever to the right (toward the spindle carrier) to open the collet in the first position. This releases the collet's grip on the bar stock, allowing a butt end to be removed or a new bar to be loaded.

The hand chucking lever must be moved to the left to close the collet before the spindle carrier is indexed. A collet safety cam on the main drum shaft will automatically close the collet before the spindle carrier indexes if the operator forgets to close the collet manually. This safety cam also prohibits the hand chucking lever from being operated except when the machine is in the normal stock loading position.

CAUTION: Never use a lever longer than the one furnished with the machine or an extension on the hand chucking lever to increase leverage when manually operating the collet in the first position.

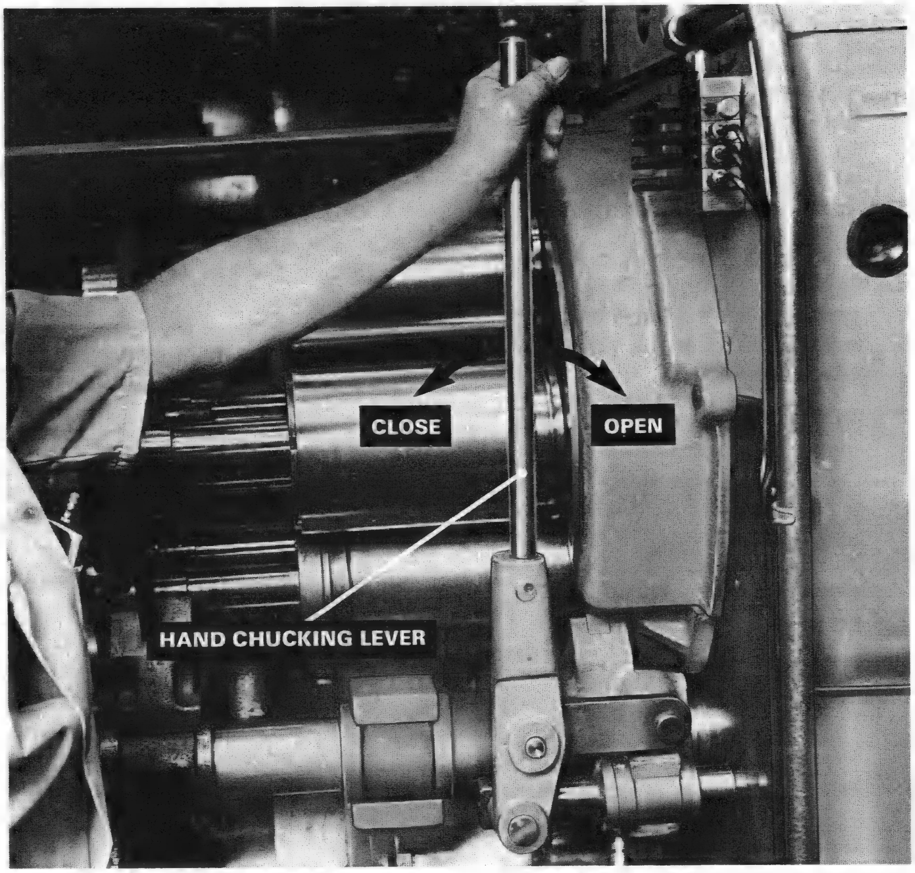


Fig. E-3. Hand chucking lever.

General Instructions

Your Acme-Gridley Multiple Spindle Bar Machine will perform to its full potential only if you operate it properly. Follow the procedures outlined in this manual and comply with all of the following operating instructions.

1. Establish a working preventive maintenance program as outlined in Maintenance, section F, page 18.
2. Clean the machine regularly. Do not clean the machine while it is operating under power.
3. Always attend the machine when it is running to minimize damage resulting from a malfunction should one occur.
4. Check over the machine occasionally to see that all screws are in place and adjust as necessary.
5. Only use wrenches of the proper size for all nuts and bolts.

Stock, Chucking and Collets

1. Use only National Acme made collets, pushers and spool bushings that match the size and shape of the bar stock.
2. Chamfer both ends of each bar before it is loaded in the machine so it will pass thru the pusher and collet properly. Failure to do so may result in a damaged pusher or collet.
3. Always close and lock the guard disc on the pusher tube aligning disc after each restocking of the machine.
4. Be sure all spindles are loaded with stock, the finger holder oil guard over the finger holders and pusher tubes is in place, and the guard disc on the pusher tube aligning disc is closed and locked before running machine.
5. When adjusting collets, be sure they are tight enough to prevent slipping of the stock under machining conditions. Do not overtighten.
6. The collet in the automatic chucking position should be fully open or fully closed whenever the main drive motor is being run. Pressures exerted between the rotating finger holder spool and the chucking shoe by a partially opened or closed collet will cause rapid wear to the chucking shoe.
7. Always check to see that the stock stop is retracted after you disengage the feed clutch. A retracted stock stop indicates that the collet is closed.
8. Whenever the spindles are turning without the spindle carrier indexing for an extended length of time (a maximum of 12 times the cycle time), be sure to index the spindle carrier periodically to assure that all the work spindles are lubricated adequately.
9. Under normal conditions, when it is required to stop the machine, do so after completing an index. If the machine has been stopped at half index, be sure chucking shoe and finger holder spool are aligned before completing index. Disengage the high speed clutch (shift into low speed) and then jog the machine to complete the index. This will minimize the load on the indexing mechanism.
10. Always stock the machine with equal length bars. Bars of unequal length can cause erratic indexing of the spindle carrier (especially on large machines).
11. Bars must not extend beyond the ends of the stock reel tubes when the stock reel tubes are full forward and locked in place.

Motor and Operating Levers

1. Feed clutch should be disengaged when starting the main drive motor. The one exception is when setting tools and jogging the machine.
2. Allow sufficient time for the lubricating system to start functioning properly before engaging the feed clutch.
3. When stopping the machine, disengage the feed clutch before stopping the main drive motor.
4. Use the high speed clutch lever only when tools are not cutting (loading stock and setting up).

Cams, Clutches and Brakes

1. The height on the stock feed cam should be great enough to push the bar stock against the stock stop and maintain some pressure. Keep over travel to a minimum as it will cause unnecessary wear on the pushers.
2. The lead on the end toolslide cam and the cross slide cams should be enough to advance the tools the required distances while allowing an adequate amount for approach and stop pressure.
3. Each time a cam is changed, check cam roll clearance along the complete cam track and grease the roll path. Be sure the cam is securely fastened to its drum.
4. Check adjustments of all clutches periodically. When a clutch is adjusted properly, reasonable pressure on the hand operating lever will close the clutch completely.
5. High speed clutch must disengage before the brake operates.
6. Tension on the brake should be enough to cause a snug drag on the hand crank as the machine is hand cranked past the brake cam. See Maintenance, section F, page 16.
7. Be sure to put the main disconnect in the OFF position before starting any work on cams, clutches or the brake.
8. Cross slide stops should be readjusted each time the cross slide cams are changed.
9. End toolslide stop nut should be readjusted each time the end toolslide cam is changed.

Tools, Toolholders and Gibs

1. After installing an attachment or making a major adjustment, crank or jog the machine thru one complete cycle to make sure everything clears before running the machine under power.
2. Set tool shanks into their toolholders far enough to assure a full grip. Be sure there is a minimum overhang to provide adequate support of the tools.
3. When setting tools, make allowances for ample chip clearance and coolant supply lines.
4. Check to be sure that only correct end toolslide toolholders are used on the end toolslide. Each end toolslide toolholder is stamped with the serial number of the machine and its correct position on the end toolslide. These numbers must face the gearbox when the toolholders are mounted.
5. Move tools and toolholders carefully. Loosen hold down screws before moving toolholders. Use a dial indicator and adjusting screws.
6. Grind and set tools carefully. This is important to achieve maximum efficiency of the tools.
7. Check that all drill points are of correct length. Correct drill point lengths are listed in any good machinist's handbook. A handy rule-of-thumb is that any drill point should be about 3 tenths the diameter of the drill bit. Example for a ½" drill: 0.3 x 0.5 = 0.150" point length.
8. Keep dies and taps sharp in order to cut clean and accurate threads.
9. When an option is available, it is good practice to use dies and taps that cut 70 to 80% of thread depth. Such a thread is almost as strong as a full depth thread and is easier to cut. This will increase threading tool life.
10. When adjusting gibs on cross slides and end toolslide, make them snug but not tight enough to bind.

Lubricants and Coolants

1. Keep an adequate supply of lubricants and coolants in their respective reservoirs.
2. Keep all moving parts not served by the automatic lubricating system well lubricated.
3. Always use good quality lubricants.
4. Check oil flow in sight glass regularly to be sure there is a steady stream of oil flowing when the machine is running.
5. Check coolant being used to be sure it is correct for the job. Rate of production and tool life are dependent upon the use of the correct coolant.
6. Remove coolant from the machine and thoroughly clean the coolant reservoir, removing all sediment and fine chips. For a recommended schedule, refer to Maintenance, section F, page 20.
7. Be sure the filter screens over the lubricant and coolant intake pipes are clean and in place at all times.
8. For instructions on maintenance of lubricating oil filter, refer to Maintenance, section F, page 2.
9. After setting up a job, check to be sure that all tools have an ample supply of coolant directed at the cutting edge of the tool before running production.

SECTION F: MAINTENANCE
Table of Contents

General Maintenance 2
  Lubricating System 2
    Oil Filter 2
    Types of Lubricants 3
    Air Line Lubrication 3
    Auxiliary Equipment 3
    Lubrication Schedule 3
    After Repairs or Installation 3
  Coolant System 4
    Types of Coolants 4
    Coolant Maintenance Schedule 4
  Safety Devices 6
    Large Worm Wheel Friction Plate 6
    Positive Releasing Ball Type Slip Clutch 8
    Pulley Shaft Shear Pins 9
  Operating Clutches 10
    Twin Disc Clutch 10
    Pullmore Clutch 10
    Power Reverse Clutch 11
    Roll Clutch Assembly 11
  Other Machine Adjustments 12
    Spindle Carrier Clamping Mechanism 12
    Spindle Carrier End Play 13
    End Play in Gear Train Shafts 13
    Spindle Bearings 13
    Collets 13
    Stock Depletion Pressure Switch and Regulator (Standard on RA, RN and RAN models only) 13
    Attachments 13
  Indexing the Spindle Carrier Manually 14
    Design A Locking Pin 14
    Design B Locking Pin 15
  Setting High Speed, Low Speed and Brake Cams (Fig. 18) 16
    Set High Speed Cam 16
    Set Low Speed Cam 16
    Set Brake Cam 16
    Adjust Brake Torque 16
Preventive Maintenance 18
  Operator Machine Care 18
  Daily Maintenance 18
  Bi-Weekly Maintenance 18
  Monthly Maintenance 19
  Quarterly Maintenance 20
  Semi-Annual Maintenance 20
  Annual Maintenance 21

General Maintenance

Lubricating System

Acme-Gridley Multiple Spindle Bar Machines require a minimum of general care for maximum service life and trouble-free operation. The lubricating system (Fig. F-1) consists of a pressurized oil distribution system and oil cups or grease fittings at points not serviced by the pressure system. Independent motor driven accessories require individual servicing.

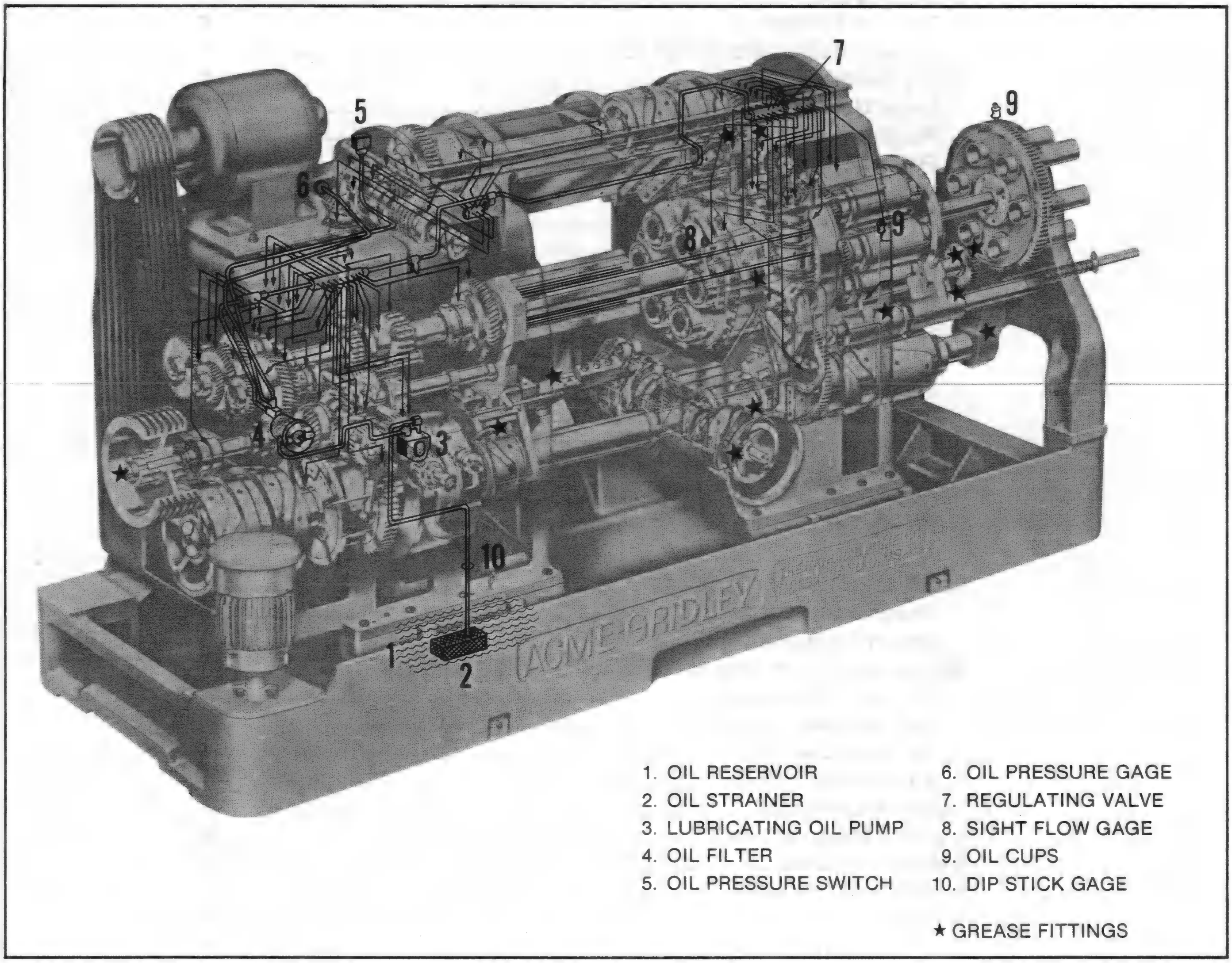
The pressurized oil distribution system supplies oil to the moving parts in the gearbox and headstock sections of the machine and to the chucking shoes. On machines equipped with an oil pressure switch (1¼" RB-8 and larger), the pressure switch is set to operate at 7 to 13 pounds pressure. The pump is driven directly, or indirectly, by the constant speed shaft so that oil is pumped thru the feeder lines at all times when the main drive motor is running. An oil sight flow gage is provided to check the flow visually.

The intake pipe in the oil reservoir is protected by a screen, which should periodically be cleaned.

Supplementary automatic lubricating systems are available as an option. They are furnished to automate the manual lubrication system. The maintenance for this system is described in a separate manual.

Oil Filter

An oil filter is located either in the gearbox or top section of the machine to remove fine particles from the oil. The handle on the filter should be turned at least two times per shift. The filter should be removed and thoroughly cleaned every two weeks. Remove the holding screws holding the cover to the frame, and remove the entire filter unit. Do not remove the filter while the machine is operating. Wash the filter thoroughly in a suitable cleaning fluid. Remove any sludge from the filter housing that remains on the machine.



1. OIL RESERVOIR
2. OIL STRAINER
3. LUBRICATING OIL PUMP
4. OIL FILTER
5. OIL PRESSURE SWITCH
6. OIL PRESSURE GAGE
7. REGULATING VALVE
8. SIGHT FLOW GAGE
9. OIL CUPS
10. DIP STICK GAGE

★ GREASE FITTINGS

Fig. F-1. Lubricating oil system of 2⅝" RB-6 shown from rear side.

Types of Lubricants

Recommended lubricating oil is a good quality conventionally refined machine oil having a viscosity range of 180 to 250 SSU at 100° F. For 7/16" RA-6 and machines using spindle speeds above 2000 rpm, use a good quality conventionally refined machine oil having a viscosity range of 90 to 160 SSU at 100° F. Grease fittings should be filled daily with a good quality NLGI grade 2 water resistant grease.

Air Line Lubrication

The proper lubrication of air tools, valves, cylinders, motors, etc., requires the use of an oil that is specifically recommended for use in air line lubricators. An air line lubricant is often subjected to very adverse conditions; high temperatures, dirty air and oxidation caused by flowing air are a few. Pneumatic devices are likewise subjected to these same conditions, plus the fact that they may sit idle for long periods of time. Unless the oil has superior oxidation stability and high film strength, it will blow off the surfaces to be oiled leaving a tacky residue known as "varnish."

An important criterion is viscosity. If an oil is too heavy, it will not be atomized and carried downstream to the component requiring lubrication. Often it will reclassify in the pipe. While it is impossible to guarantee the success of any lubricating oil because of the variables, we have found that oils having the following characteristics usually perform quite well:

1. Viscosity: 100 - 150 SSU at 100° F.
2. High Viscosity Index: over 90.
3. Superior oxidation stability as determined by ASTM test D943: over 2000.
4. Anti-foaming.
5. High film strength.
6. Compatible with Buna N rubber.
7. Aniline range: 180 - 210.

Consult your supplier for his recommendations of an oil which meets these specifications.

For a partial list of lubricants which meet all of the foregoing specifications, refer to Appendix, section H, page 16.

Auxiliary Equipment

Machines equipped with chip conveyors, outside coolant pumps and other independently operating equipment should also have their gearboxes filled with a good quality conventionally refined machine oil having a viscosity range of 125 to 150 SSU at 210° F.

Lubrication Schedule

Proper lubrication and cleanliness are the greatest contributing factors toward realizing the full Acme-Gridley operating capabilities over a long service life. Refer to "Preventive Maintenance" at the end of this section for a suggested service schedule.

After Repairs or Installation

After any repair work or installation of new attachments, check all oil lines to be sure they are properly directed on the bearings, shoes, etc., for the mechanism they lubricate. Check that lines are not plugged or pinched and are clear of gears and other rotating or moving mechanisms. To prevent loss or contamination of oil, keep attachment holes in the gearbox plugged whenever attachments are not installed.

Table F-1. Pump and Reservoir Capacities of Lubricating Systems.

Machine Size and Model	Pump (GPM)	Reservoir (Gallons)
4 Spindle:		
2⅝" RBC-4	3	20
3½" RB-4	3	25
4½" BRG-4	3	25
4½" RBT-4	3	25
5½" RB-4	3	25
5½" RBT-4	3	25
7¾" RB-4	4	50
8" RBN-4	4	50
6 Spindle:		
7/16" RA-6	0.8	9
9/16" RA-6 and 9/16" RAN-6	3	15
⅝" RN-6	0.9	15
1" RA-6 and 1" RAN-6	3	15
1¼" RA-6	3	15
1⅝" RB-6	3	20
2" RB-6	3	20
2⅝" RB-6	3	25
3½" RB-6	3	25
4" RB-6	3	25
6" RB-6	4	50
8 Spindle:		
¾" RA-8	3	15
1¼" RB-8	3	20
1⅝" RBN-8	3	25
1⅝" RB-8	3	25
2" RB-8	3	25
2⅝" RB-8	3	25
3½" RB-8	3	25
4" RB-8	4	50

Coolant System

Coolant is supplied to the tooling area under pressure from the reservoir in the pan of the machine. (Fig. F-2) Distribution is thru manifolds on the main frame sections. An independent, motor-driven coolant pump is located at the front end of the pan. A coolant switch is provided to turn the pump OFF when coolant is not desired. When the coolant switch is ON, the coolant pump will automatically operate whenever the main drive motor is running.

Types of Coolants

The type of coolant depends upon many variable factors in the cutting process: type of material being cut, type of machining operation, type of material, design of the tool, etc. In most cases the selection of the coolant will be a compromise that best satisfies the cutting conditions. This is an area where great technological improvements are being made constantly, and it is recommended that the user be guided by his own experience in the use of coolants or contact suppliers to obtain the latest recommended type. A list of references is provided in the Appendix, section H, page 16.

Coolant Maintenance Schedule

Refer to "Preventive Maintenance" at the end of this section for a suggested coolant system service schedule.

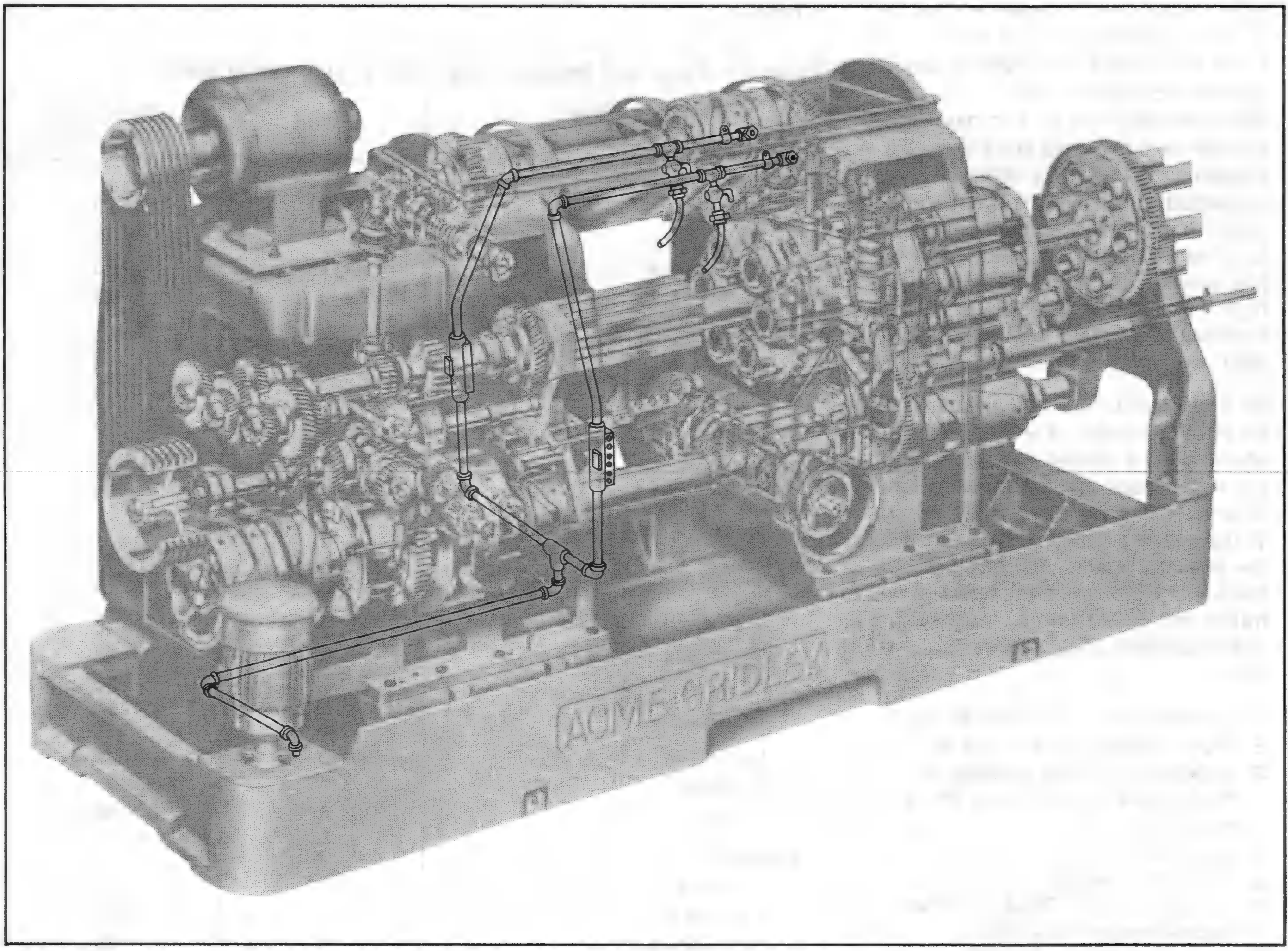


Fig. F-2. Coolant system of 2⅝" RB-6 shown from rear side.

Table F-2. Pump and Reservoir Capacities of Coolant Systems.

Machine Size and Model	Pump (GPM)	Reservoir* (Gallons)
4 Spindle:		
2⅝" RBC-4	60	200
3½" RB-4	60	250
4½" BRG-4	60	250
4½" RBT-4	60	250
5½" RB-4	60	250
5½" RBT-4	60	250
7¾" RB-4	100	350
8" RBN-4	100	350
6 Spindle:		
7/16" RA-6	15	50
9/16" RA-6 and 9/16" RAN-6	42	100
⅝" RN-6	35	100
1" RA-6 and 1" RAN-6	42	100
1¼" RA-6	42	120
1⅝" RB-6	60	200
2" RB-6	60	200
2⅝" RB-6	60	250
3½" RB-6	60	250
4" RB-6	60	250
6" RB-6	100	350
8 Spindle:		
¾" RA-8	42	120
1¼" RB-8	60	200
1⅝" RBN-8	60	250
1⅝" RB-8	60	250
2" RB-8	60	250
2⅝" RB-8	100	250
3½" RB-8	100	250
4" RB-8	100	350

*Allowance for conveyor not made

Safety Devices

Large Worm Wheel Friction Plate

The main drum shaft of machines thru serial numbers shown in Table F-3 is driven thru a friction plate system on the large worm wheel. This friction plate permits the large worm wheel to slip and avoid severe damage to the machine should a malfunction occur during the operation of the machine. The torque on this mechanism is set at the factory on new machines but should be checked periodically to assure that the system is in good working order.

Procedure for checking the friction plate system is as follows:

1. Main disconnect must be in OFF position.
2. Block the revolving arm with an adequate oak bar to prevent rotation. (Fig. F-3)
3. Machine must be in FEED mode. (Disengage the high speed clutch.) Scribe a mark on the large worm wheel and on the friction plate. Momentarily jog the machine several times, checking to see if the large worm wheel slips. Under these conditions, the large worm should slip. Slippage will be indicated by a separation of the scribe marks.
4. Scribe a new line in another location. Remove the block from under the revolving arm, permitting the machine to run under power. Run the machine, cycling it thru several complete cycles while feeding stock and making parts. Under these conditions the large worm wheel should not slip. Stop the machine and, with main disconnect in OFF position, check the scribe marks. The scribe marks should remain in line indicating that the large worm wheel has not slipped during a normal cycle.
5. To adjust the torque setting of the friction plate assembly, adjust the screws on the friction disc plate. Screws must be torqued equally to assure equal pressure from each providing even pressure on the thrust plate. (Fig. F-4)

Table F-3. Machines with Large Worm Wheel Friction Plate.

Machine Size and Model	Thru Serial Number
7/16" RA-6	All
9/16" RA-6	All
9/16" RAN-6	All
⅝" RN-6	All
¾" RA-8	All
1" RA-6	All
1" RAN-6	All
1¼" RA-6	All
1¼" RB-8	All
1⅝" RB-6	All
1⅝" RBN-8	All
1⅝" RB-8	85307
2" RB-6	All
2" RB-8	85307
2⅝" RBC-4	All
2⅝" RB-6	84526-A
2⅝" RB-8	96274
3½" RB-4	83229
3½" RB-6	94526
3½" RB-8	None
4" RB-6	BA-92084
4" RB-8	None
4½" BRG-4	None
4½" RBT-4	None
5½" RB-4	B-92077
5½" RBT-4	None
6" RB-6	BC-88029
7¾" RB-4	88300
8" RBN-4	None

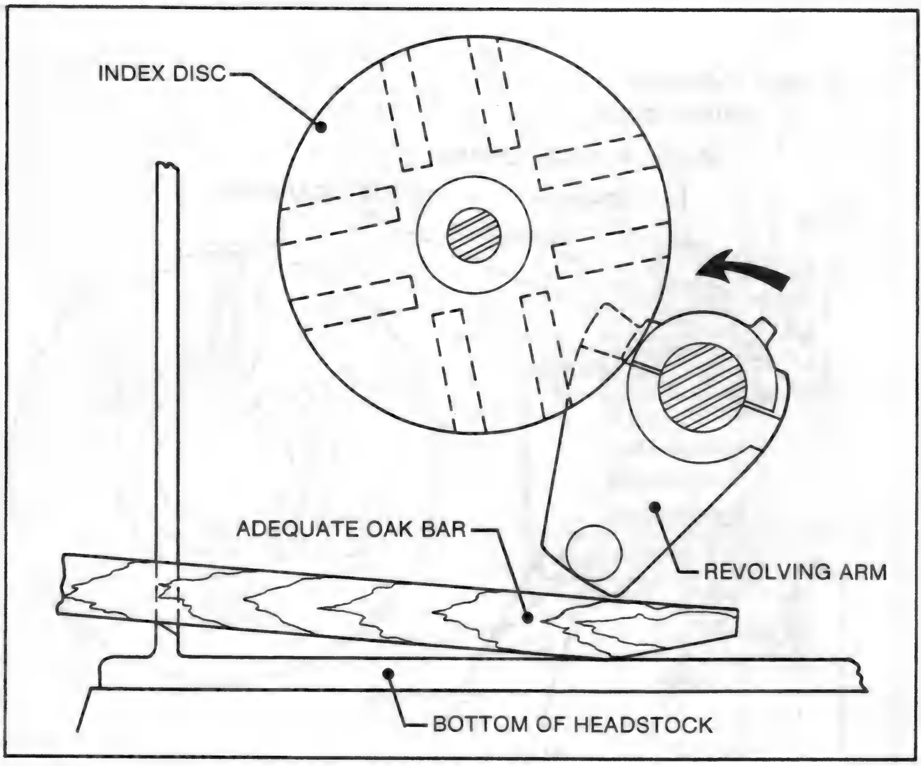

INDEX DISC
ADEQUATE OAK BAR
REVOLVING ARM
BOTTOM OF HEADSTOCK

Fig. F-3. Block revolving arm with oak bar.

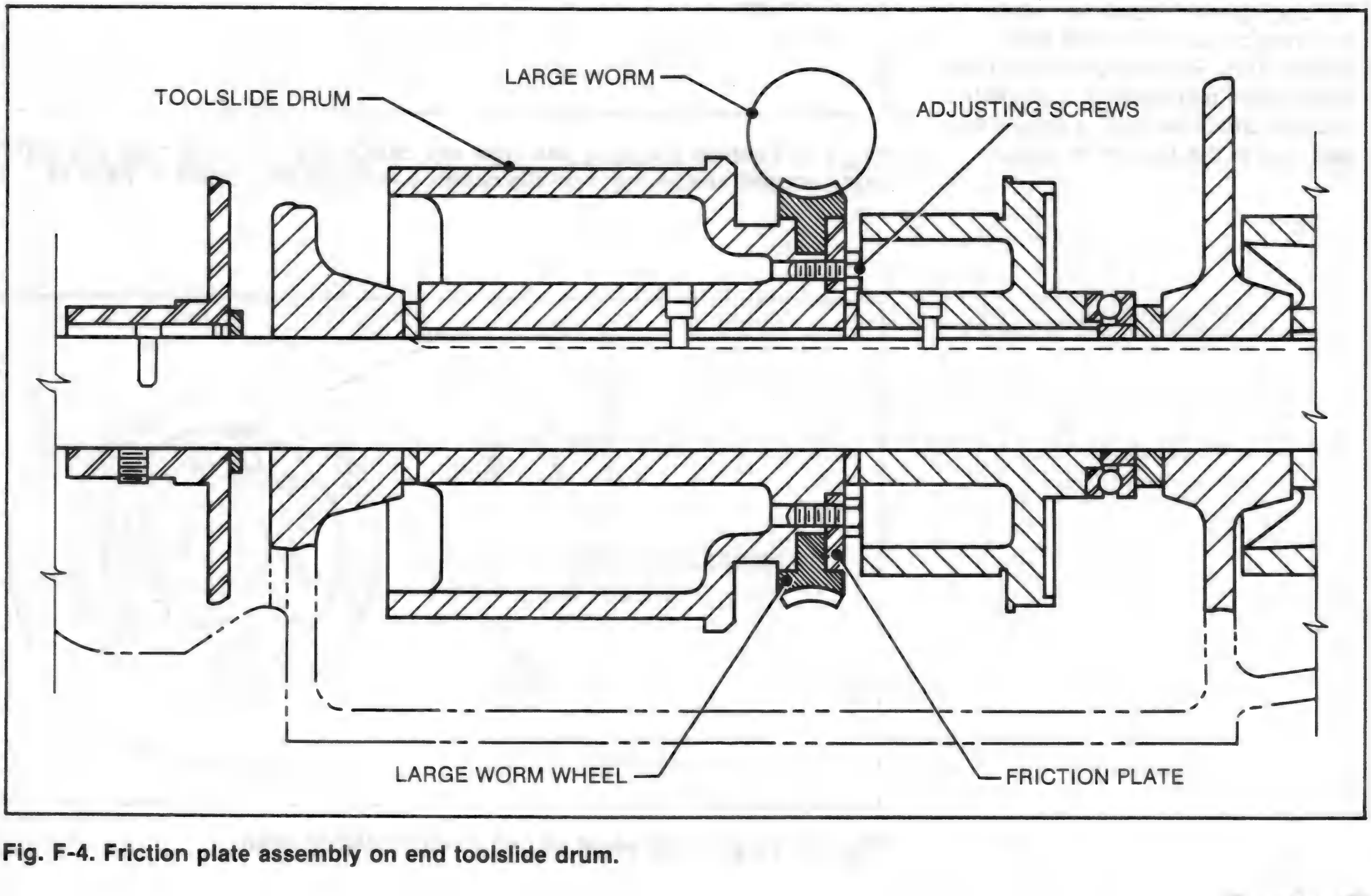

TOOLSLIDE DRUM
LARGE WORM
ADJUSTING SCREWS
LARGE WORM WHEEL
FRICTION PLATE

Fig. F-4. Friction plate assembly on end toolslide drum.

Positive Releasing Ball Type Slip Clutch

On some models of machines, the large worm wheel friction plate system has been replaced with a positive releasing ball type slip clutch. (Fig. F-5) Refer to Table F-4 for models and starting serial numbers. These machines have a worm and worm wheel top slide drive. To keep the top slide drive from getting out of time with the main drum shaft, the large worm friction plate must be tightened securely in addition to being rigidly pinned. (Fig. F-6) The positive releasing ball type slip clutch is a non-adjustable clutch and requires no maintenance.

The positive releasing ball type slip clutch is an integral part of the feed clutch assembly. This mechanism automatically disengages the feed drive should an overload occur, avoiding serious damage to the machine. The malfunction causing the overload must be removed before resetting this clutch. The positive releasing ball type slip clutch is reset by jogging machine slowly while applying pressure to reset lever handle. (Fig. F-7) If clutch continues to slip after malfunction is corrected and the clutch is reset, it should be returned to the factory for repair.

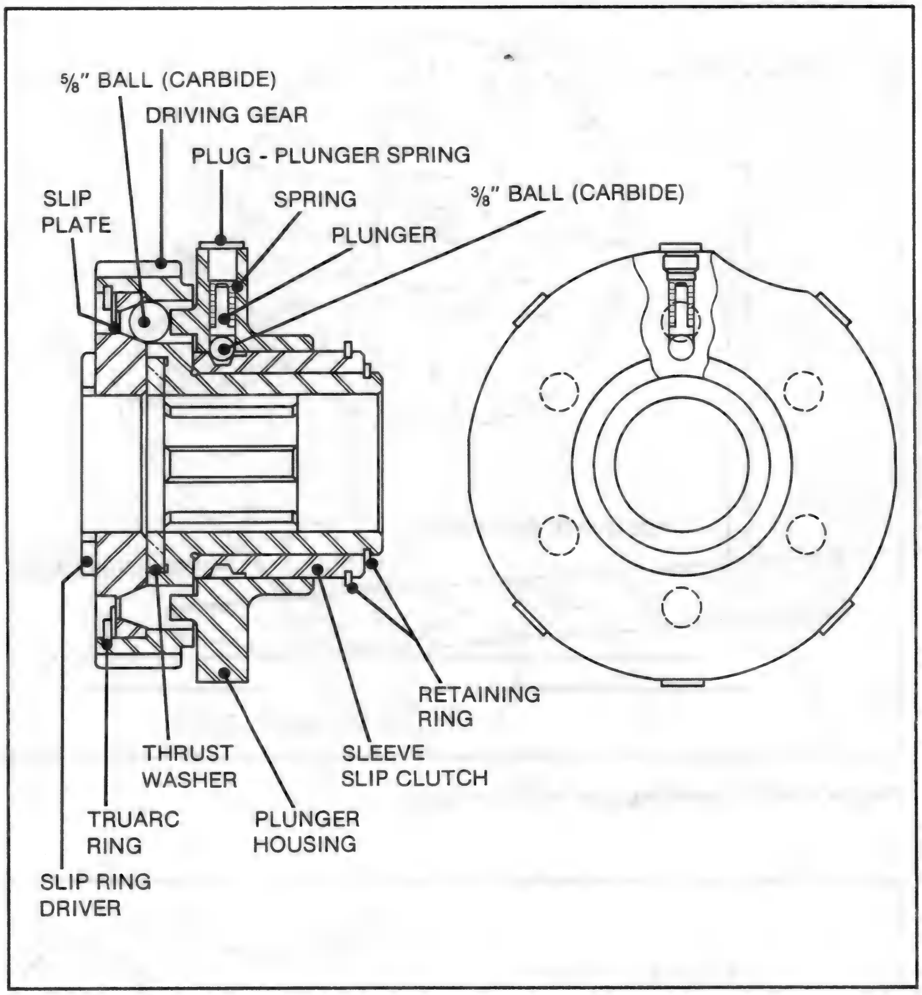

⅝" BALL (CARBIDE)
DRIVING GEAR
PLUG - PLUNGER SPRING
SLIP PLATE
SPRING
⅜" BALL (CARBIDE)
PLUNGER
RETAINING RING
THRUST WASHER
SLEEVE SLIP CLUTCH
TRUARC RING
PLUNGER HOUSING
SLIP RING DRIVER

Fig. F-5. Positive releasing ball type slip clutch. (For machine sizes and serial numbers with ratcheting style slip clutch, see Appendix, section H, page 15.)

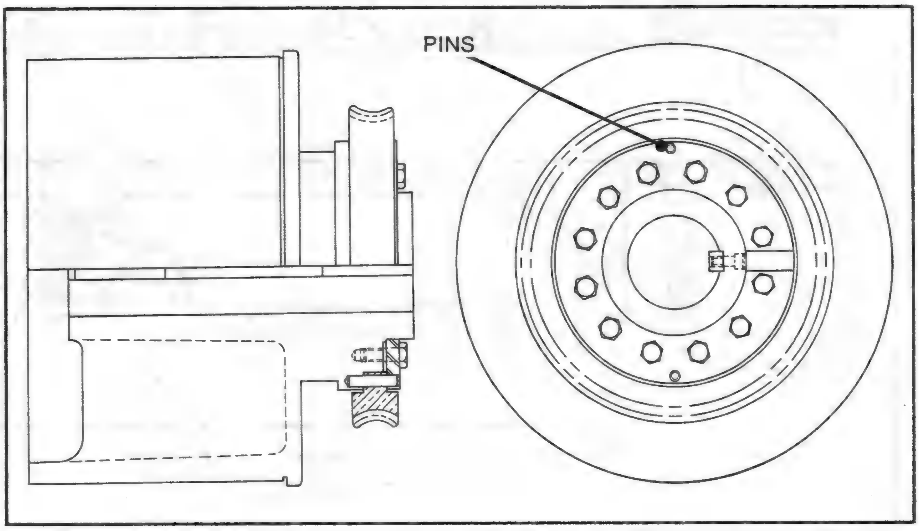


Fig. F-6. Large worm wheel pinned on end toolslide drum.

Pulley Shaft Shear Pins

A shear pin driving collar is mounted on the pulley drive shaft to protect the work spindles as well as the cross slides from overloads. In the event of an overload, the pins in the assembly will shear, allowing the motor to continue to run with the machine stopped. The pins are mounted in the drive collar which is held in place by a round split nut. (Fig. F-8) Adjust this nut to obtain 0.003 to 0.005 inch pulley end play. Check the end play after the nut is locked in place.

Lack of end play prevents the pins from shearing, canceling their protective function. Sheared pins can be replaced by loosening the nut, disassembling the driving sleeve and driving collar and inserting new pins. Use mild steel SAE 1020 CRS or equivalent. Never use hardened steel pins. Apply all purpose cup grease to collar faces, collar bushing and pulley bushing when replacing shear pins.

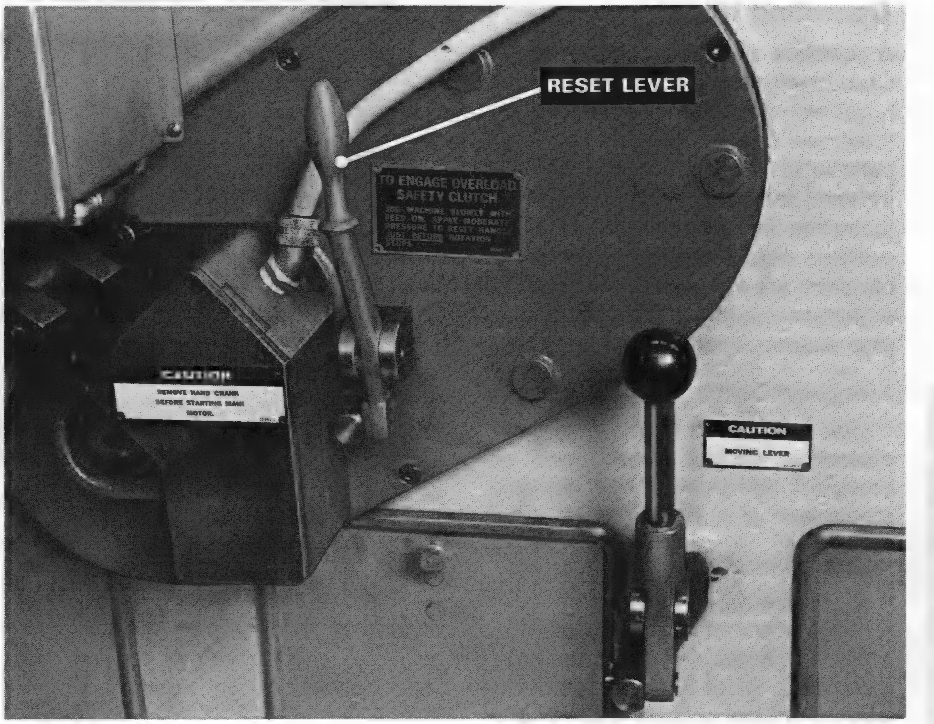

RESET LEVER
TO ENGAGE OVERLOAD SAFETY CLUTCH
CAUTION
REMOVE HAND CRANK BEFORE STARTING MAIN MOTOR.
CAUTION
MOVING LEVER

Fig. F-7. Reset lever for positive releasing ball type slip clutch.

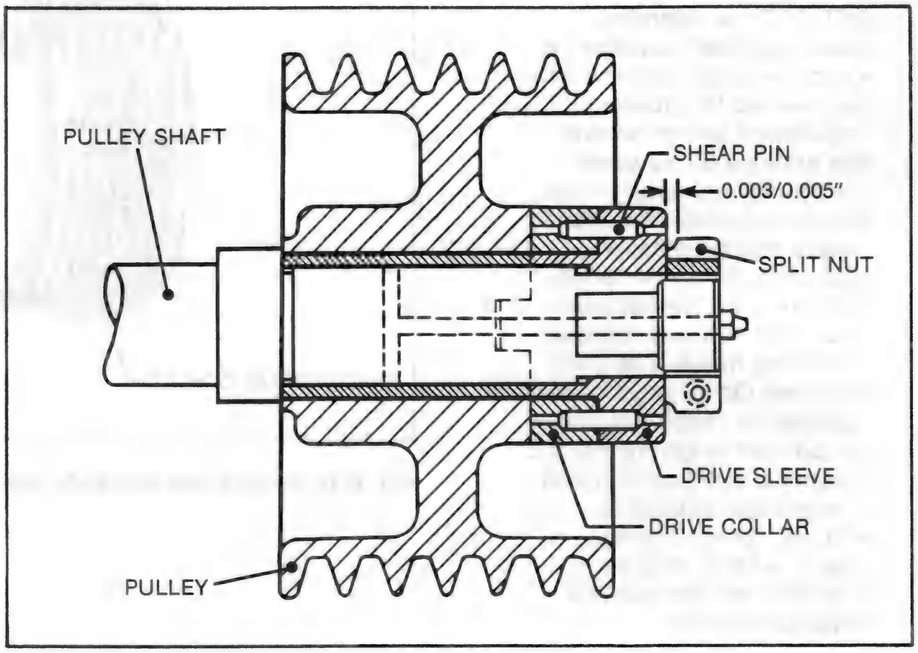

PULLEY SHAFT
SHEAR PIN
0.003/0.005"
SPLIT NUT
DRIVE SLEEVE
DRIVE COLLAR
PULLEY

Fig. F-8. Shear pins and retaining nut.

Table F-4. Models and Starting Serial Numbers of Machines with Ball Type Slip Clutches (Large Worm Wheel Pinned).

Machine Size and Model	Starting Serial Number
1⅝" RB-8	85308
2" RB-8	85308
2⅝" RB-6	84527-A
2⅝" RB-8	96275
3½" RB-4	83230
3½" RB-6	94527
3½" RB-8	BM-94001
4" RB-6	BA-92085
4" RB-8	BM-83001
4½" BRG-4	B-92188-G
4½" RBT-4	B-92146T
5½" RB-4	B-92078
5½" RBT-4	B-92201T
6" RB-6	BC-88029
7¾" RB-4	88301
8" RBN-4	BD-88001

Operating Clutches

Adjustable disc type clutches are used on the constant speed shaft, large worm shaft and threading attachments. They are also used on spindle stopping machines for independent spindle stopping. The main disconnect must be in the OFF position before any adjustments to clutches are made. Several styles of adjustable clutches are used and their adjustments are as follows:

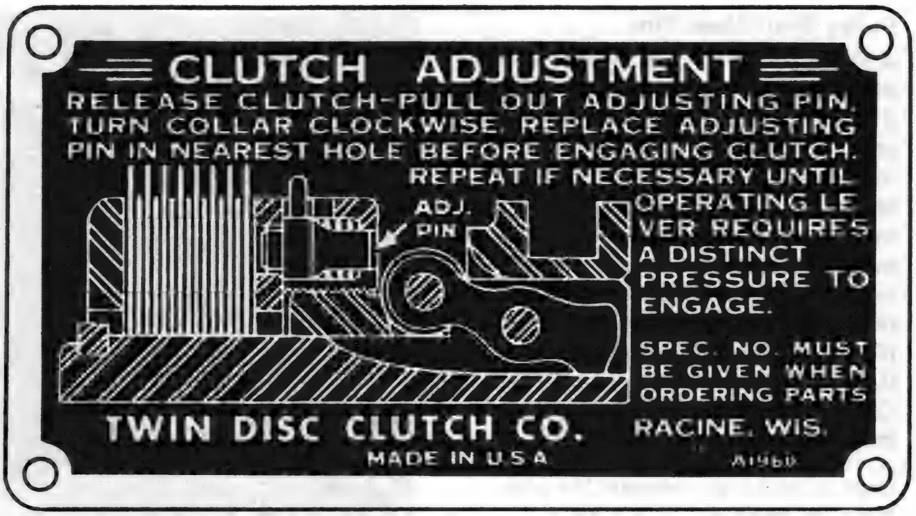
Twin Disc Clutch

If slippage occurs in this type clutch, disengage the clutch and adjust using the instructions on the clutch nameplate. (Fig. F-9)

Pullmore Clutch

If slippage occurs in this type clutch, disengage the clutch and spread the pressure plate away from adjusting collar (Fig. F-10) enough to clear the teeth. Turn the adjusting collar one tooth at a time until correct pressure is obtained when the clutch is engaged.

> NOTE: On all operating clutch applications, after the clutch is adjusted, it should be checked for proper adjustment before running the machine under power. On mechanical applications, manually operate the yoke to assure that the shipper sleeve has full travel. Some resistance will be felt while the clutch is being engaged, indicating that it is properly adjusted. On air applications, operate the clutch with the air cylinder to assure that the shipper sleeve has full travel. A slight hesitation of the shipper sleeve while the clutch is being engaged indicates that the clutch is properly adjusted.



CLUTCH ADJUSTMENT

RELEASE CLUTCH-PULL OUT ADJUSTING PIN. TURN COLLAR CLOCKWISE. REPLACE ADJUSTING PIN IN NEAREST HOLE BEFORE ENGAGING CLUTCH. REPEAT IF NECESSARY UNTIL OPERATING LEVER REQUIRES A DISTINCT PRESSURE TO ENGAGE.

SPEC. NO. MUST BE GIVEN WHEN ORDERING PARTS

TWIN DISC CLUTCH CO. RACINE, WIS.

MADE IN U.S.A.

A1960

Fig. F-9. Twin disc clutch nameplate.

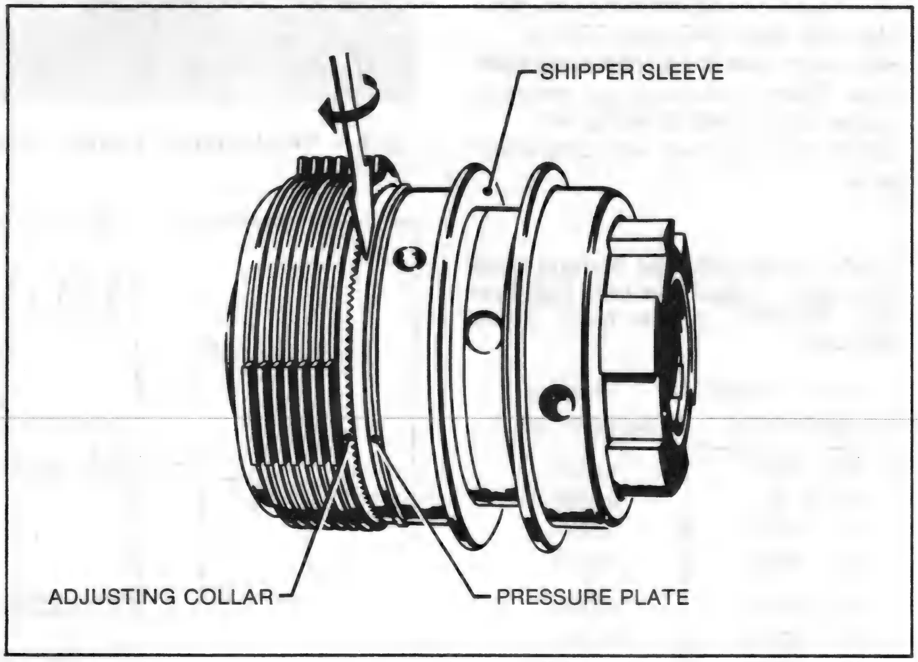


Fig. F-10. Spread pressure plate away from adjusting collar (Pullmore Clutch).

Power Reverse Clutch

Larger machines are provided with a power reverse clutch (Fig. F-11) to drive the machine in reverse under power. This clutch is adjusted by releasing the locking screw and turning the adjustment spider clockwise. The adjustment spider should be turned approximately one-quarter of a turn, the locking screw tightened, and the clutch tried to see if there is enough pressure to drive. Do not adjust more than one-quarter of a turn at a time between checks to avoid damage.

> NOTE: Power reverse is only active thru the cutting portion of the cycle and the approach of the toolslide cam. For limit switch controlling travel, refer to Fig. D-57, section D, page 30.

> NOTE: On all operating clutch applications, after the clutch is adjusted, it should be checked for proper adjustment before running the machine under power. On mechanical applications, manually operate the yoke to assure that the shipper sleeve has full travel. Some resistance will be felt while the clutch is being engaged, indicating that it is properly adjusted. On air applications, operate the clutch with the air cylinder to assure that the shipper sleeve has full travel. A slight hesitation of the shipper sleeve while the clutch is being engaged indicates that the clutch is properly adjusted.

Roll Clutch Assembly

All machines are provided with a roll clutch assembly (Fig. F-12) permitting the power transmission to provide two speeds to the large worm shaft: one speed for normal feed and the other speed for high speed or idle time. Should the machine fail to go into feed rate speed, it is generally this clutch which is malfunctioning. The clutch must be removed from the machine for repair.

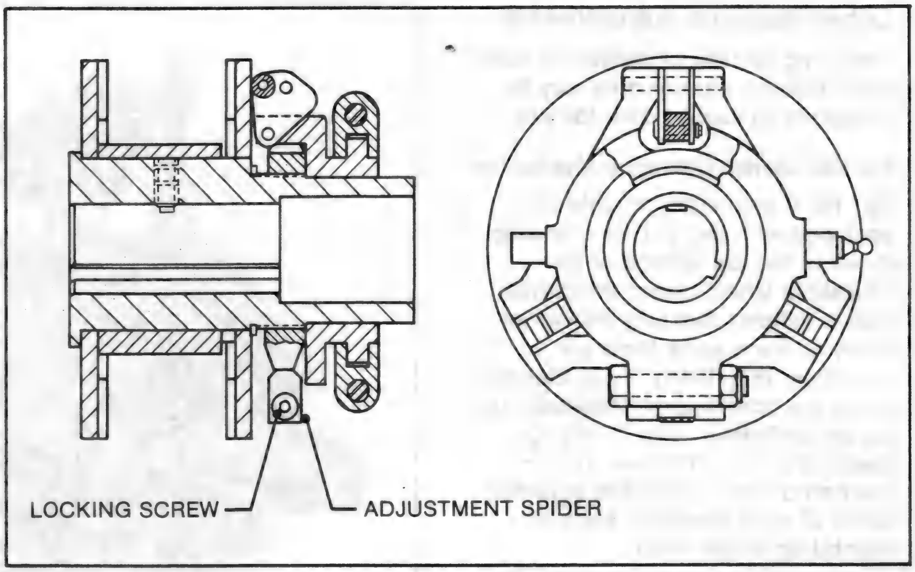


Fig. F-11. Power reverse clutch.

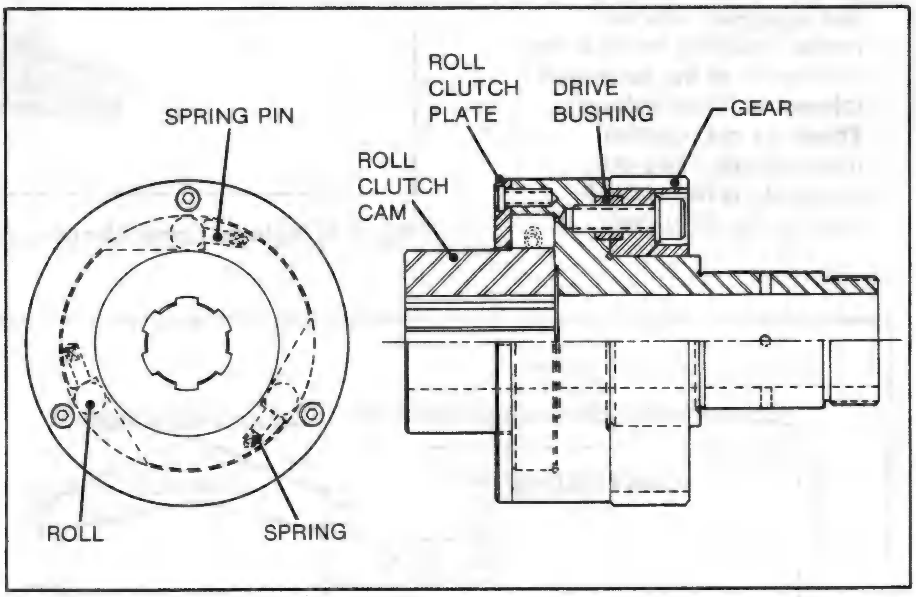


Fig. F-12. Roll clutch assembly.

Other Machine Adjustments

After long periods of operation, some slight bearing adjustments may be necessary to compensate for wear.

Spindle Carrier Clamping Mechanism

2⅝" RB-6 and larger models are equipped with two carrier clamping shoes in the top section of the headstock which clamp the carrier after it indexes, holding the carrier firmly in place while tools are in operation. (Fig. F-13) These clamping shoes are operated mechanically and are set as follows. (Fig. F-14) Jog machine so cam follower rolls are on low part of their cams. Set adjusting screw of each clamping shoe so a slight drag is felt when corresponding cam follower roll is rotated by finger pressure. Lock each adjusting screw with locking nut.

CAUTION: Each machine is also equipped with two carrier snubbing shoes in the top section of the headstock (closest to finger holders). These are not operated mechanically. They are preset at the factory and must not be disturbed.

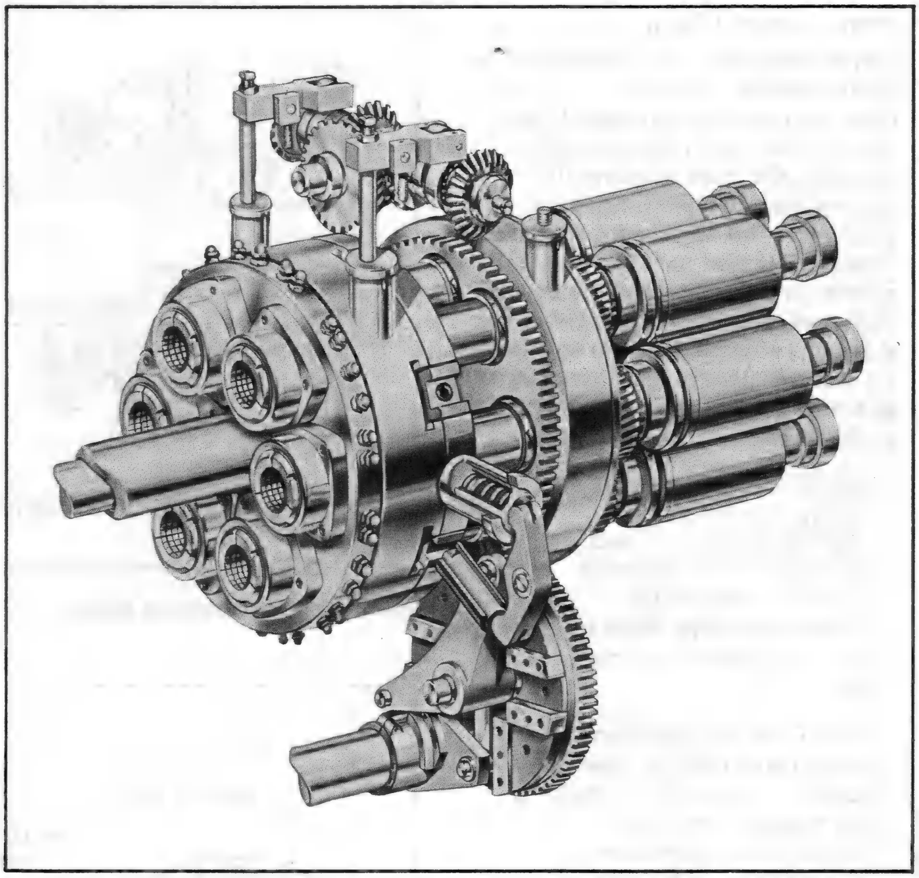


Fig. F-13. Spindle carrier clamping mechanism adjustment.

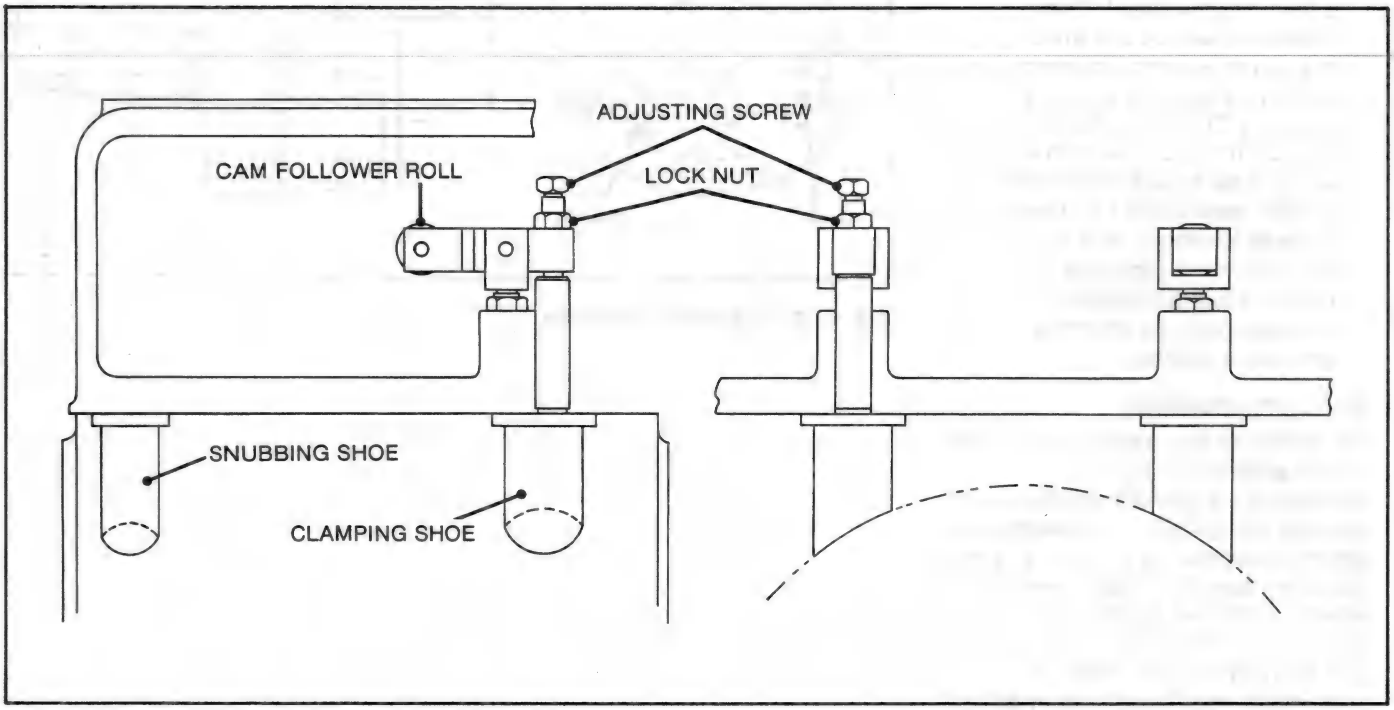


Fig. F-14. Spindle carrier clamping mechanism adjustment.

Spindle Carrier End Play

Excessive end play in the spindle carrier can cause rejected parts because of part length variations. Control end play with the adjusting nut (Fig. F-15) located on the end of the carrier stem immediately behind the first wall inside the gearbox. To adjust end play:

1. Jog the machine to position carrier so locking pin is partially out and carrier is free to move.
2. Loosen binder screw on adjusting nut only enough to allow nut to turn.
3. Turn the nut to draw the carrier toward the gearbox until end play is removed. Avoid overtightening because the bearings may be damaged.
4. Tighten binder screw and complete the index by jogging.

End Play in Gear Train Shafts

Most shafts have an adjusting nut used in conjunction with one of their bearings. Careful adjustment, if necessary, should eliminate end play but allow the shaft to be free running.

Spindle Bearings

Spindle bearings are factory installed with the proper load for long, satisfactory service. They should be checked only by personnel trained to handle the precision bearings. Before adjusting spindle bearings, contact National Acme for instructions.

Collets

Remove and thoroughly clean collets, collet tubes and the pusher tubes regularly. Also clean internal diameter of work spindles. For detailed instructions, refer to Setup, section D, page 12. Small chips find their way in between the collet and the spindle in spite of the felt or neoprene slugs in the collet slots. Failure to clean out collets, collet tubes and pusher tubes is one prime reason for faulty stock feeding. Whenever possible, direct the coolant flow away from the spindle nose and collet to avoid washing chips into the collet and collet tube area.

Stock Depletion Pressure Switch and Regulator (Standard on RA, RN and RAN models only)

This device is set at the factory. Setting instructions are provided on the electrical diagram.

Attachments

After repair work, installation of new attachments or adjustments of attachments, jog or crank machine thru one complete cycle to check clearances and/or binding. Install plugs in bearing bores of gearbox when an attachment is removed.

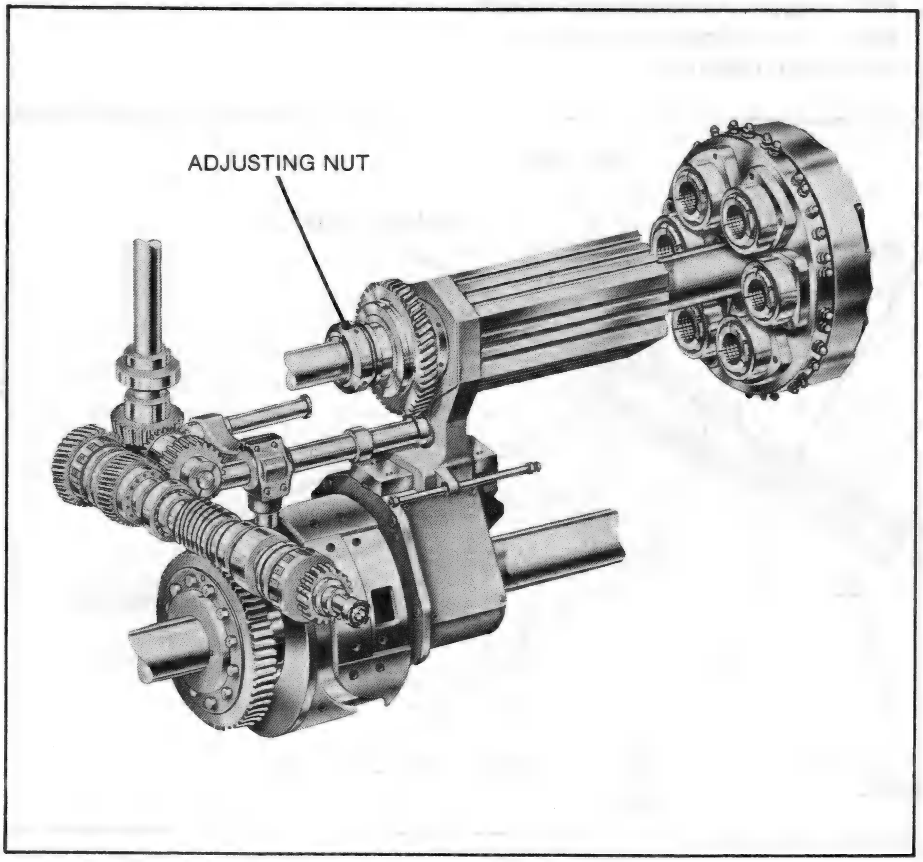


Fig. F-15. Spindle carrier end play adjusting nut.

Indexing the Spindle Carrier Manually

The spindle carrier can be indexed manually when the main disconnect is in OFF position by withdrawing the locking pin from the locking pin block as described below.

Two different locking pin designs are used on the various models of machines. With Design A, the locking pin spring is located directly behind the locking pin. (Fig. F-16) With Design B, the locking pin spring and the locking pin are located in separate bores and spring pressure is applied on the locking pin by means of a rocker arm. (Fig. F-17)

Design A Locking Pin

1. Put the main disconnect in the OFF position.
2. Check to be sure that the spindle carrier is in a fully indexed position and the roll on the revolving arm is clear of the slot in the index disc.
3. Check to be sure that the hand chucking, chucking and stock feed slides are fully retracted.

Insert the threaded rod, provided with the locking pin removal kit, thru the locking pin cap and thread it into the hole in the end of the locking pin until it is fully seated. (Fig. F-16) Slip the sleeve (in kit) over the end of the threaded rod. Screw one of the hex nuts from the kit onto the threaded rod, bringing the sleeve in contact with the locking pin cap. Continue tightening the nut until the locking pin is withdrawn from the locking pin block far enough to clear the outside diameter of the spindle carrier.

CAUTION: Never remove the cap holding screws (Fig. F-16) unless you are going to remove the locking pin as described below.

The spindle carrier can now be indexed manually. Use a bar of wood as a lever across one spindle nose and the spindle carrier stem to rotate the spindle carrier to the desired position. When the desired position is reached, release the locking pin spring by unscrewing the hex nut on the threaded rod allowing the locking pin to seat into the locking pin block. Remove the complete locking pin removal kit assembly.

To completely remove the locking pin from the machine, start with the above procedure until the locking pin is withdrawn from the locking pin block. Then loosen the locking pin stud binder screw and withdraw the locking pin stud until it is clear of the slot in the side of the locking pin. Unfasten the locking pin cap and remove the complete assembly from the machine.

CAUTION: Do not loosen the cap holding screws until the locking pin spring is compressed and held rigidly by the nut on the threaded rod of the locking pin removal kit.

NOTE: When reassembling the locking pin (with either Design A or B), a minimum of 0.001 inch or a maximum of 0.002 inch clearance must be provided between the bottom of the locking pin stud and the slot in the locking pin to assure proper operation of the locking pin assembly.

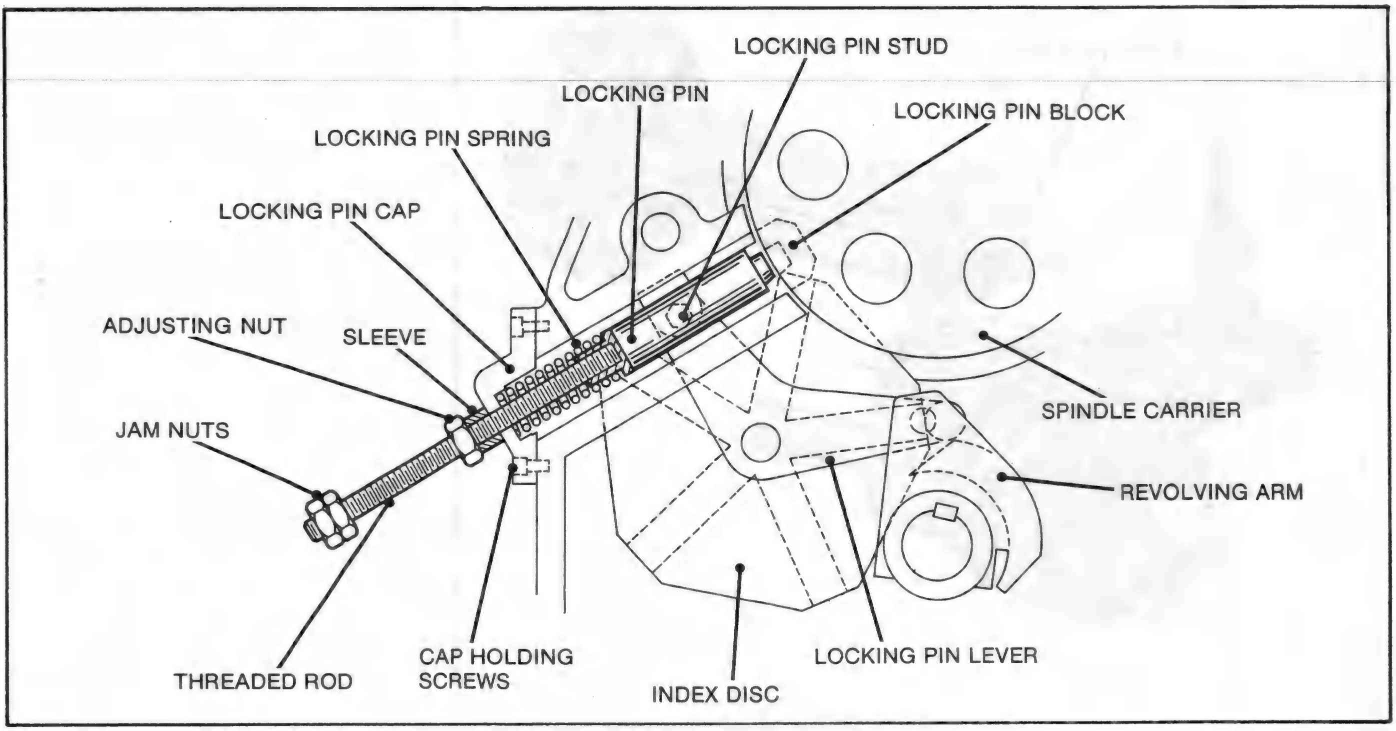


Fig. F-16. Design A where locking pin spring is located directly behind the locking pin.

Design B Locking Pin

1. Put the main disconnect in the OFF position.
2. Check to be sure that the spindle carrier is in a fully indexed position and the roll on the revolving arm is clear of the slot in the index disc.
3. Check to be sure that the hand chucking, chucking and stock feed slides are fully retracted.

Remove the cover located over the locking pin and locking pin spring assembly. Insert the threaded rod, provided with the locking pin removal kit, thru the slot in the rocker arm and the hole in the sliding spring sleeve. Screw the rod into the hole in the bottom of the stationary spring bushing until it is fully seated and then back the rod off one-half turn. (Fig. F-17) Slip the sleeve from the kit over the threaded rod and thru the slot in the rocker arm until it rests against the end of the sliding spring sleeve. Screw one of the hex nuts from the kit onto the threaded rod until it touches the sleeve. Screw two of the hex nuts from the kit onto the end of the threaded rod and lock together as jam nuts. While holding the threaded rod from turning with a wrench on the jam nuts, tighten the adjusting nut against the sleeve until spring tension on the locking pin is relaxed. Pull back on the locking pin lever and withdraw the locking pin from the locking pin block far enough to clear the outside diameter of the spindle carrier.

The spindle carrier can now be indexed manually as described under "Design A." After the spindle carrier has been rotated to the desired position, release the locking pin spring by unscrewing the hex nut on the threaded rod allowing the locking pin to seat into the locking pin block. Then remove the complete locking pin removal kit assembly and replace the cover over the locking pin and locking pin spring assembly.

To completely remove the locking pin from the machine, start with the above procedure until the spring tension on the locking pin is relaxed. Then remove the rocker arm. Loosen the locking pin stud binder screw and withdraw the locking pin stud until it is clear of the slot in the side of the locking pin. Remove the locking pin.

> NOTE: When reassembling the locking pin (with either Design A or B), a minimum of 0.001 inch or a maximum of 0.002 inch clearance must be provided between the bottom of the locking pin stud and the slot in the locking pin to assure proper operation of the locking pin assembly.

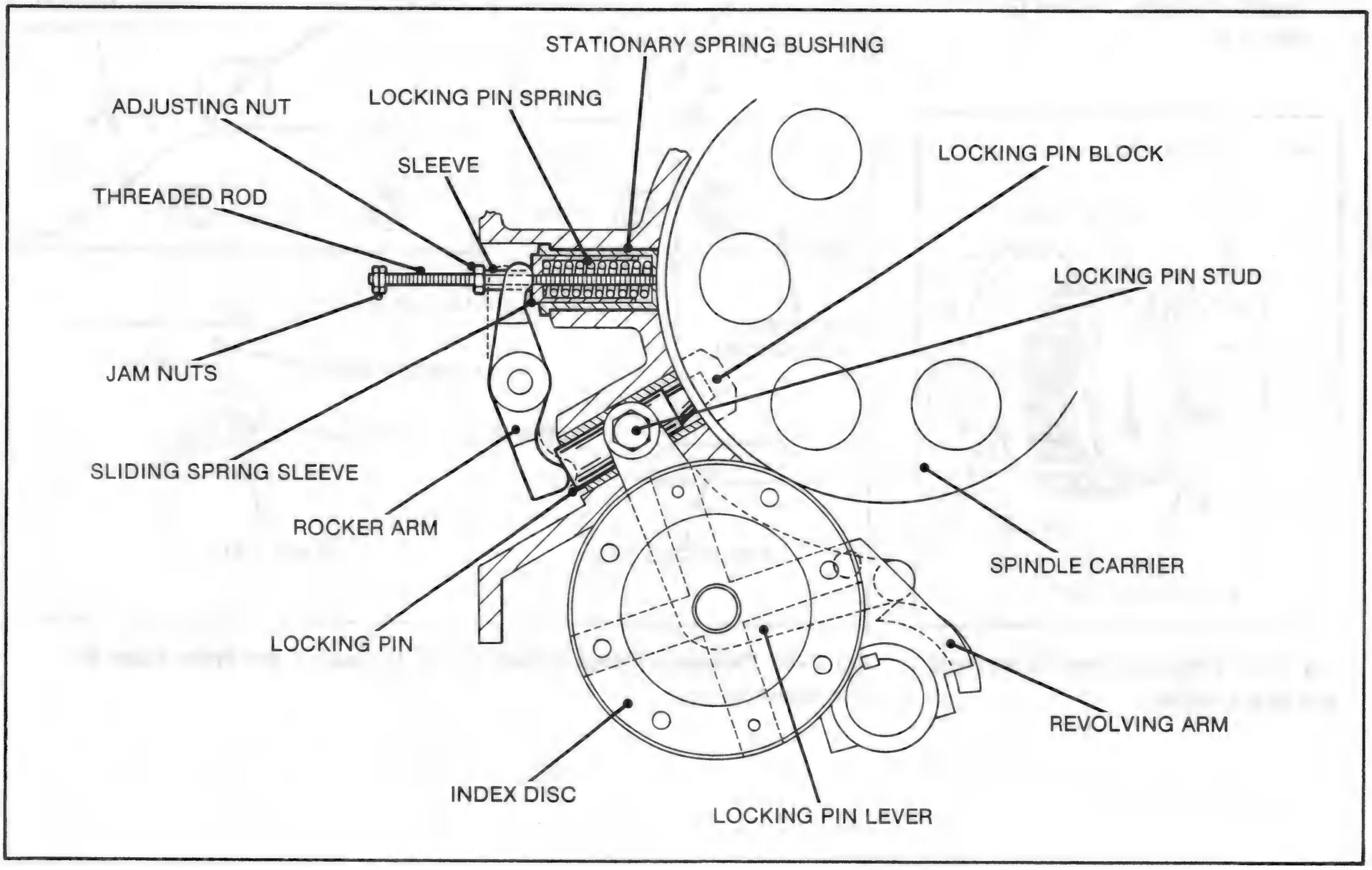


Fig. F-17. Design B where locking pin spring and locking pin are located in separate bores.

Setting High Speed, Low Speed and Brake Cams (Fig. 18)

CAUTION: Main disconnect must be in OFF position while performing these steps.

NOTE: Proper setting of high speed, low speed, and brake cams assures maximum production and minimum cycle time. These cams do not normally require repositioning when changing setups.

Set High Speed Cam

The high speed cam (Fig. F-18) should be set so the machine goes into high speed when the end toolslide roll is at high point. (Fig. F-19)

CAUTION: Setting the high speed cam so the machine shifts into high speed before the tools have finished cutting may result in several malfunctions. (See Troubleshooting, section G, page 3.)

Set Low Speed Cam

The low speed cam (Fig. F-18) is set to disengage high speed clutch when the toolslide roll is approximately halfway up the approach of the toolslide cam. (Fig. F-19) Check cycle time with stop watch and adjust low speed cam accordingly.

Set Brake Cam

The brake cam (Fig. F-20) should be set so the brake lever roll is on the center of the brake cam when the end toolslide roll is on exact low point. (Fig. F-19)

NOTE: Determine exact low point by measuring the distance from the end toolslide guide to the stop nuts. This amount should equal the lead on the end toolslide cam.

Adjust Brake Torque

With brake lever roll on brake cam, adjust brake to torque load shown in Table F-5. Use torque wrench and adaptor to check torque.

NOTE: Torque readings in Table F-5 are for new machines with no tooling. These readings may require modification for such factors as worn machine, loose gibs, slides not operating, etc. On 9/16" and 1" RA-6, RAN-6 and 1¼" RA-6 machines, be sure cone snubbing brake on large worm shaft is not dragging when checking torque.

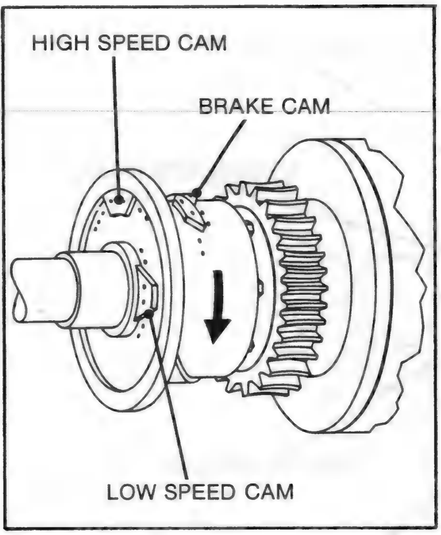

HIGH SPEED CAM
BRAKE CAM
LOW SPEED CAM

Fig. F-18. Set high speed, low speed and brake cams.

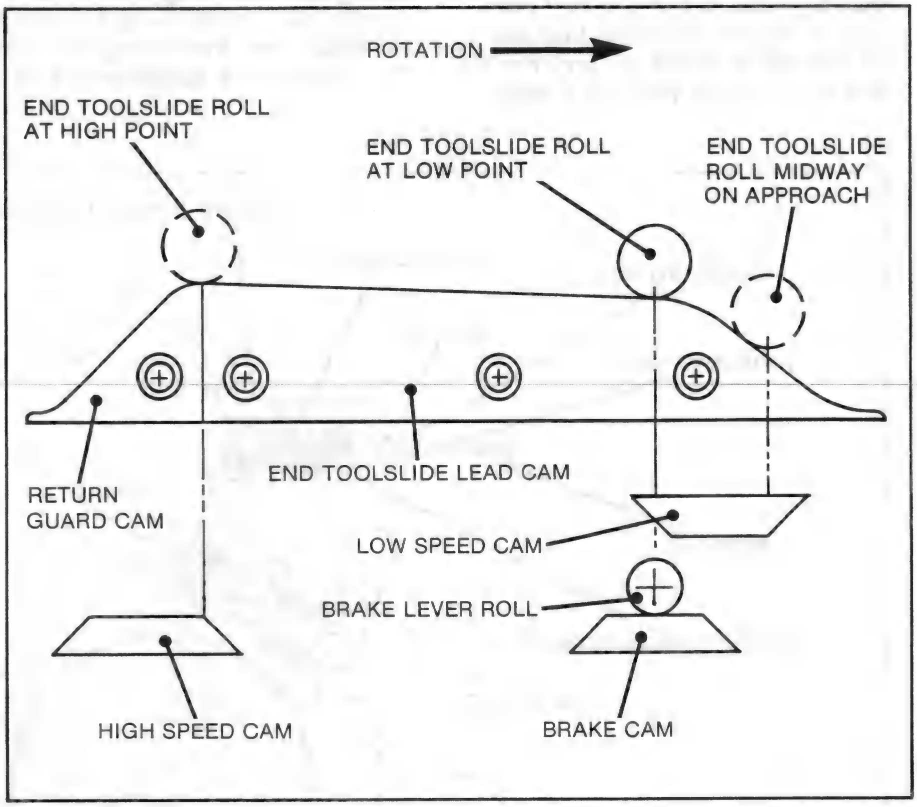

ROTATION
END TOOLSLIDE ROLL AT HIGH POINT
END TOOLSLIDE ROLL AT LOW POINT
END TOOLSLIDE ROLL MIDWAY ON APPROACH
RETURN GUARD CAM
END TOOLSLIDE LEAD CAM
LOW SPEED CAM
BRAKE LEVER ROLL
HIGH SPEED CAM
BRAKE CAM

Fig. F-19. Relative settings of high speed, low speed and brake cams to end toolslide cam.

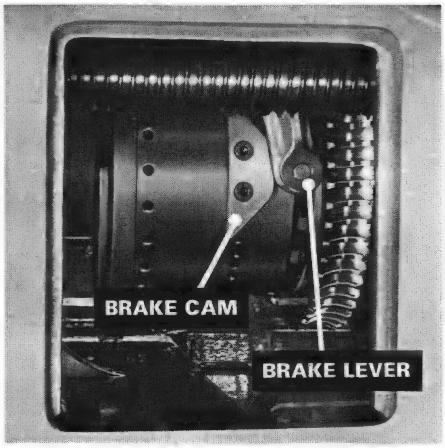

BRAKE CAM
BRAKE LEVER

Fig. F-20. Set brake cam.

Table F-5. Torque Wrench Adaptor Numbers.

Machine Size and Model	Torque Wrench Adaptor Number	Torque in Lb-Ft
7/16" RA-6	D-44400	15
9/16" RA-6	D-44401	22
9/16" RAN-6	D-44401	22
5/8" RN-6	D-44401	22
3/4" RA-8	D-44402	28
1" RA-6	D-44401	22
1" RAN-6	D-44401	22
1 1/4" RA-6	D-44402	28
1 1/4" RB-8	D-44404	50
1 5/8" RB-6	D-44404	40
1 5/8" RBN-8	D-44404	50
1 5/8" RB-8	D-44404	40
2" RB-6	D-44405	40
2" RB-8	D-44404	40
2 5/8" RBC-4	D-44404	40
2 5/8" RB-6	D-44404	40
2 5/8" RB-8	D-44404	50
3 1/2" RB-4	D-44404	40
3 1/2" RB-6	D-44404	50
3 1/2" RB-8	D-44404	50
4" RB-6	D-44404	50
4" RB-8	D-44405	50
4 1/2" BRG-4	D-44404	50
5 1/2" RB-4	D-44404	50
5 1/2" RBT-4	D-44404	50
6" RB-6	D-44405	50
7 3/4" RB-4	D-44405	50
8" RBN-4	D-44405	50

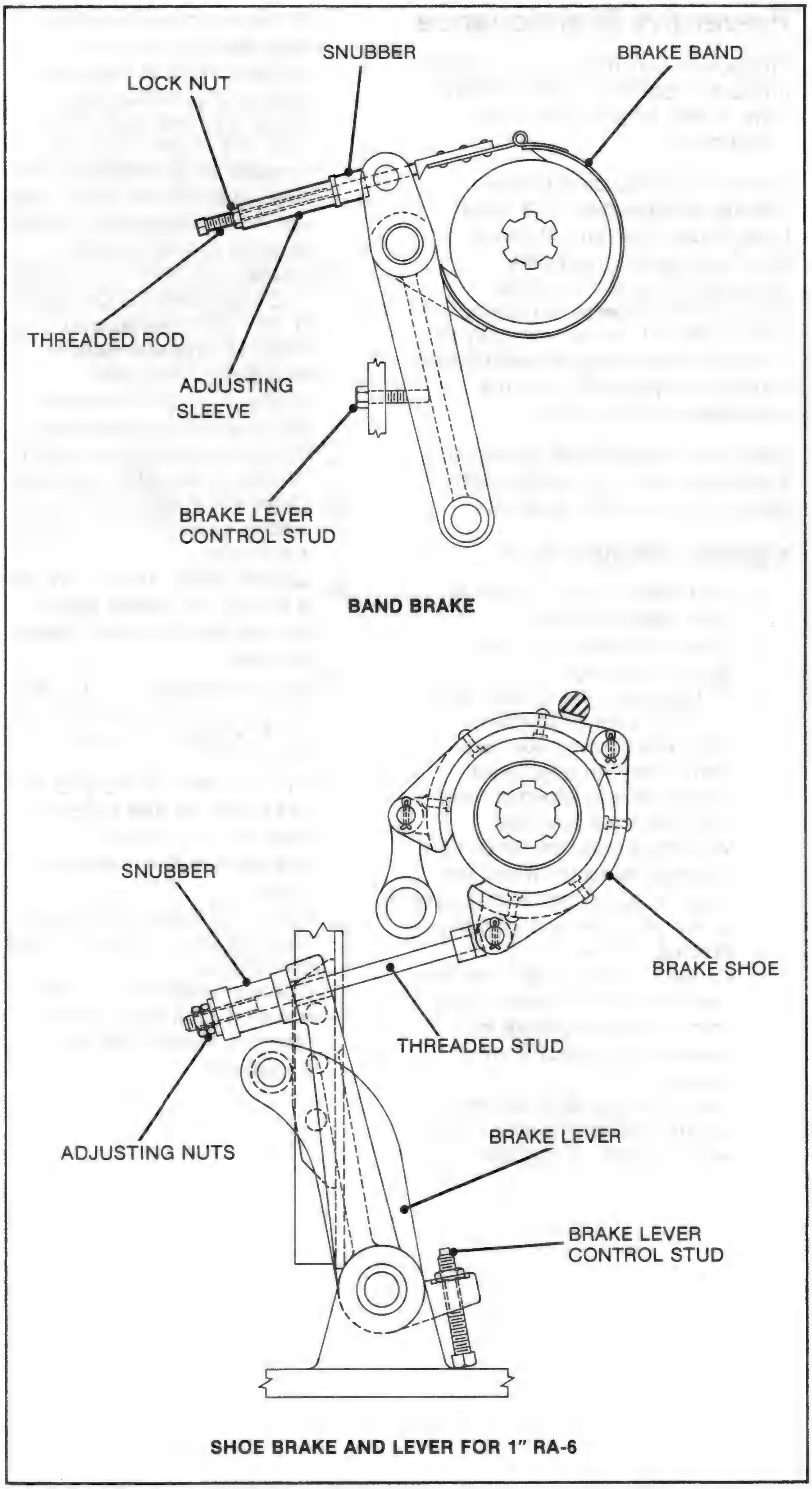

SNUBBER
BRAKE BAND
LOCK NUT
THREADED ROD
ADJUSTING SLEEVE
BRAKE LEVER CONTROL STUD
BAND BRAKE
SNUBBER
BRAKE SHOE
THREADED STUD
ADJUSTING NUTS
BRAKE LEVER
BRAKE LEVER CONTROL STUD
SHOE BRAKE AND LEVER FOR 1" RA-6

Fig. F-21. Move adjusting nuts of brake threaded rod to adjust brake tension. (For other brake styles, refer to Appendix, section H, page 14.)

Preventive Maintenance

This schedule is only a guide. Actual production conditions may require more or less frequent preventive maintenance.

A good maintenance program requires a team effort. The items listed under "Operator Machine Care" are almost always the responsibility of the machine operator. Other items, especially under "Daily Maintenance," may be handled by operating or maintenance personnel depending upon the organization of the shop.

Preventive maintenance doesn't cost; it saves by reducing rejected parts, downtime and similar problems.

Operator Machine Care

- ☐ Turn lube oil filter handle at least twice each shift.
- ☐ Check oil flow in the sight glass frequently.
- ☐ At the beginning of each shift, check to be sure there is adequate coolant flow to all tooling cutting edges and coolant flow is directed away from the work spindles.
- ☐ Wipe bars clean of dirt and grit before loading them into the machine. Coat bars with grease to reduce noise and load on feeding mechanism.
- ☐ Be sure leading ends of all bars are chamfered before loading them into the machine for easier entry into pushers and collets.
- ☐ Keep machine and floor area around the machine free from accumulated oil, dirt and debris.
- ☐ At the end of each shift, put main disconnect in OFF position. Wipe or brush all chips and grit away from slides, gibs and toolholders. Do NOT use an air hose. High pressure air is dangerous and drives grit into the slides, gibs and other mechanisms, which prevents proper operation.
- ☐ NEVER ATTEMPT TO FORCE THE MACHINE TO OPERATE in case of a hangup, poor indexing, improper clutch operation or any other malfunction. Turn machine OFF and notify a supervisor.
- ☐ Do not operate machine with improperly adjusted clutches.
- ☐ Check collet adjustment when loading new bars and readjust if necessary.
- ☐ Be sure pusher tube guard disc is closed and locked before starting machine after loading new bars.
- ☐ Do not run machine with feed OFF and collet half OPEN or half CLOSED (will cause rapid shoe wear).
- ☐ When machine is stopped on half index, be sure chucking shoe and spool are in alignment before completing index.
- ☐ Check roll clearance between lead and guard cams after each cam change.
- ☐ Check condition of cam roll and stud each time a cam is changed. Grease cam path generously.

Daily Maintenance

Check:

- ☐ Lubricating oil level in main reservoir.
- ☐ Oil level in coolant pump and chip conveyor gearboxes.
- ☐ Oil level of independent motor driven accessories.
- ☐ Oil supply in oil reservoir of stock reel support.
- ☐ Oil supply in air line lubricator.
- ☐ Oil supply in all oil cups including those in stock reel support.
- ☐ All oil cups for proper dripping rate.
- ☐ Coolant level in pan reservoir.
- ☐ Coolant intake pipe (or pump) screen; clean if necessary.
- ☐ All grease fittings and add grease.
- ☐ Chucking shoe for wear; be sure oil drip contacts shoe.
- ☐ Condition and alignment of stock reel and stock reel support.
- ☐ Lubricating oil delivery to spindle bearings.
- ☐ Cycle time with a stop watch; if too fast or too slow, refer to Troubleshooting, section G, of this manual for corrective action.

Bi-Weekly Maintenance

- ☐ Drain air filter trap — more often if needed.
- ☐ Clean screen on lube oil intake pipe.
- ☐ Drain sludge from oil filter.
- ☐ Check brake adjustment.
- ☐ Check clutch adjustments.

Monthly Maintenance

Pneumatic System

☐ Check air pressure gage settings (if any gages are installed).
☐ Check air cylinders for response and leaks.

Hydraulic System

☐ Check oil pressure gage settings (if any gages are installed).

Spindle Carrier

Remove the following items, clean thoroughly, inspect and replace:

☐ Collets.
☐ Collet tubes (cracks).
☐ Pusher.
☐ Pusher tubes.
☐ Inside of spindles.

Inspect condition of:

☐ Collet seats for cracks and wear.
☐ Collet tubes and nuts.
☐ Pusher tubes.
☐ Stop screws.
☐ End toolslide and gib adjustment.
☐ Clutches, brakes and yokes (or shoes) of spindle stopper.
☐ Operating shoes.

Rear End

Inspect wear and/or damage condition of:

☐ Stock reel.
☐ Stock reel stand.
☐ Stock feed slide, bushings, rolls and studs.
☐ Stock feed pusher plate.
☐ Stock feed slide ring.
☐ Stock feed slide pusher pull back roll.
☐ Spool guard inserts.
☐ Index slots in index disc.
☐ Roll(s) and stud on revolving arm.
☐ Roll and stud on locking pin lever.
☐ Locking pin lever stud to assure it is locked.
☐ Chucking slide, bushings, roll and stud.
☐ Chucking shoes.
☐ Locking pin spring.
☐ Stock feed shaft.
☐ Finger holders for broken or worn fingers, pins, rolls and cams.
☐ Hand chucking shoe alignment with shoe in automatic chucking slide.

Gearbox

Check wear and/or damage and adjusted condition of:

☐ Spanner nuts.
☐ Bearings.
☐ Clutches.
☐ Roll clutch.
☐ Gears — tooth wear and mounting.
☐ Shafts and splines.
☐ Pulleys and V-belts.
☐ Brake band and lining.
☐ Clutch operating yokes or shoes.
☐ End toolslide push rod roll nut (do not lock solid — must have 0.003/0.005 inch endshake).
☐ End toolslide pusher arm.
☐ End toolslide pusher roll.
☐ Stop pressure for end toolslide.
☐ Roll clutch shaft.
☐ Large worm and worm gear.
☐ Large worm shaft.
☐ Small worm.
☐ Small worm shaft.
☐ Constant speed shaft.
☐ Pulley shaft.
☐ Spindle drive shaft.

Drum Shafts

Check for:

☐ Broken drums.
☐ Worn keys or keyways.
☐ Broken taper pins.
☐ Damaged bearings.

Quarterly Maintenance

N/A

☐ Remove and thoroughly clean lube oil filter. Be sure relief valve is operating.

☐ Remove coolant from the pan and thoroughly clean pan of sediment and fine chips. Add new coolant.

15/2

☐ Check cross slide gib adjustments.

15/2

☐ On long runs where the cams are seldom changed, remove cross slide drums and clean drums and drum cavity. Regrease cam path. Check condition of roll and stud.

Semi-Annual Maintenance

General

Drain, clean, flush and refill:

☐ Main lube oil reservoir. Check condition of screen.

☐ Gearboxes on independent motor driven accessories (conveyor, pump, etc.).

ANN

Check condition of filter screen.

Spindle Carrier

Check:

☐ For excessive end play of spindles.

☐ If end toolslide needs rebushing. (Check this by putting magnetic base indicator on carrier and lift toolslide.)

☐ Carrier end play. (With locking pin partially out and carrier free to move, check end play by putting magnetic base on headstock and indicator stylus on carrier. Exert lateral force on carrier by prying with a 3″ x 3″ x 6′ oak pry bar. Adjust end play as described on page F-13 if necessary.)

Drum Shafts

☐ Check for zero backlash in bevel gears between large drum shaft and cross slide drum shaft. If necessary, remove enough shim material from cross slide drum shaft housing to attain zero backlash. (Fig. F-22)

Electrical Controls

Check condition of:

☐ Switches.

☐ Solenoid valves.

☐ Wiring.

☐ Panel box.

☐ Motors.

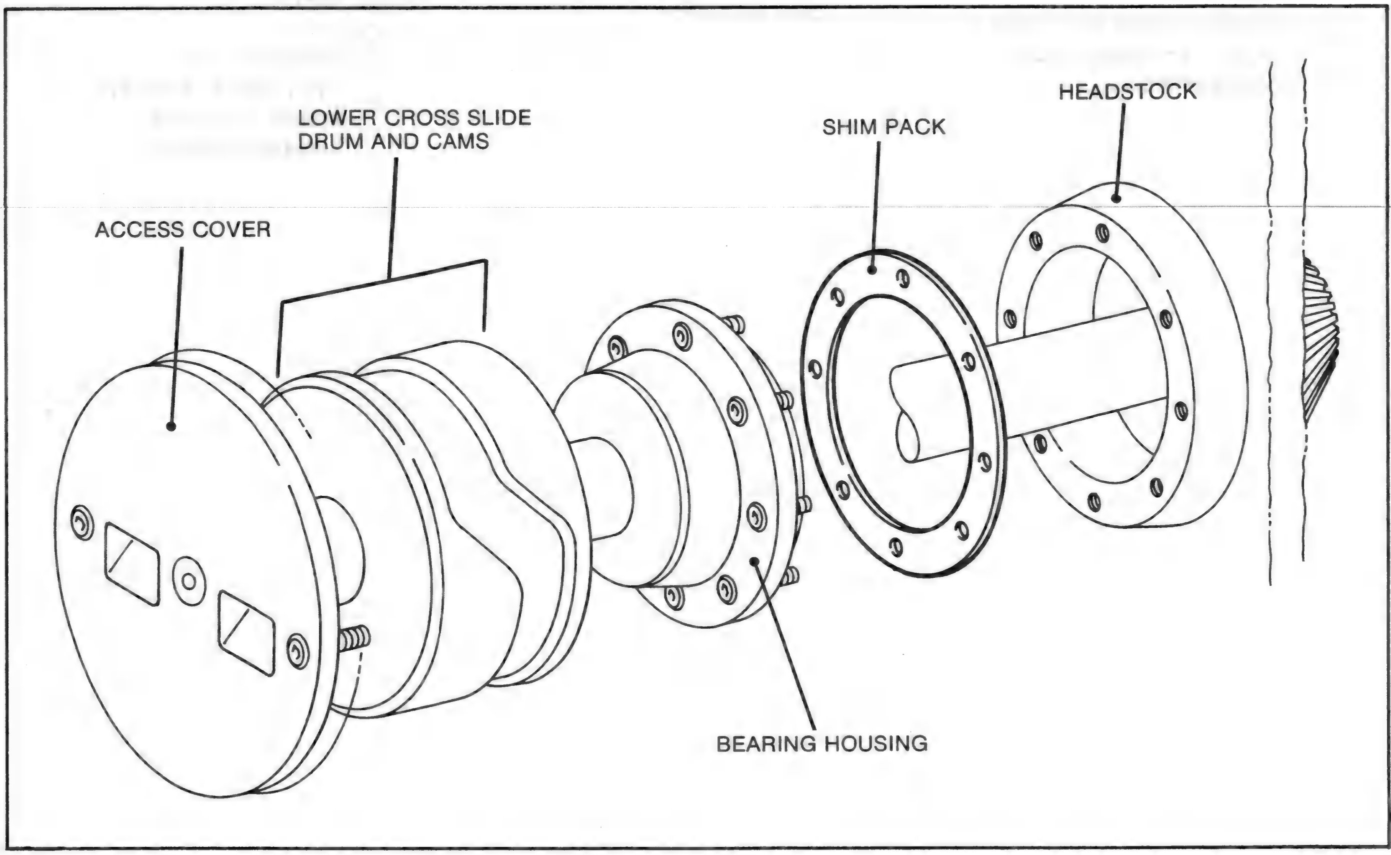


Fig. F-22. Location of shim pack on cross slide drum shaft housing.

Annual Maintenance

General

Disassemble:

- ☐ High speed, feed and threading clutches. Inspect plates, pins, fingers and springs. Replace worn parts. Clean, lubricate, reassemble and readjust.
- ☐ Roll clutch. Inspect rolls, springs and cam surfaces. Replace worn parts. Clean, lubricate and reassemble.

Check:

- ☐ Attachments for alignment with work spindles.
- ☐ Level of machine.
- ☐ For broken cross slides, top slides or intermediate slides.
- ☐ Condition of all levers, rolls and studs.
- ☐ Condition of stock stop.
- ☐ Condition of chip conveyor.

Lubricating and Coolant System

Check:

- ☐ Lubricating pump.
- ☐ Coolant pump.
- ☐ Oil/coolant lines.
- ☐ Oil/coolant filter in reservoir.

Attachments

Inspect condition of:

- ☐ Threading attachments.
- ☐ Reaming attachments.
- ☐ High speed drilling attachments.
- ☐ Pick-up attachments.
- ☐ Other special attachments.

Air and/or Hydraulic Operated Mechanisms

Check:

- ☐ Condition of gages, lines and valves.
- ☐ Condition of cylinders.
- ☐ Tightness of all fittings.
- ☐ Bowl traps.
- ☐ Pump pressure.
- ☐ Accumulators.
- ☐ Distributors.

SECTION G: TROUBLESHOOTING
Table of Contents

Two Fundamental Rules 2
Basic Approach to Troubleshooting 2
Machine Malfunctions 3
Out-of-Tolerance Parts 4
    Step 1: Determine When the Problem Started 4
    Step 2: Determine the Quantity and Type of Defects 4
    Step 3: Determine the Occurrence Pattern of Defects 4
    Step 4: Locate the Troubles and Causes 4

TROUBLESHOOTING

Two Fundamental Rules

1. Cleanliness and preventive maintenance minimize the need to refer to this Troubleshooting section. See Maintenance, section F, for details.

2. Always take the time to determine the cause of a problem before changing anything. Once determined, the cause should be corrected before solving the specific problem. Readjusting the machine to compensate for poor performance without knowing the specific cause of the problem often masks the true trouble and creates additional problems.

Basic Approach to Troubleshooting

Before troubleshooting, review the operation. What is the problem? When did it first occur — after setup or during production? Just before the problem started, was the machine restocked, a tool adjusted, or some other change made? Answers to these questions simplify locating the problem and the specific cause.

Sound can often be the first signal of developing trouble in the machine. Every machine produces a number of usual sounds as a result of its normal operation. When a malfunction starts to develop, however, one or more unusual sounds can usually be heard. These, obviously, should be checked to determine the cause.

Most machining problems will fall into one of two categories: machine malfunctions or out-of-tolerance parts. Machine malfunctions are normally detected by observing the operation of the machine. They seldom affect the quality of the parts being produced but eventually will reflect in loss of production. Out-of-tolerance parts, on the other hand, are detected by examining the completed parts. Here, the problem is often the tooling although a number of other causes can be involved.

The following troubleshooting procedures are divided into these two broad categories.

Machine Malfunctions

MALFUNCTION	CAUSE	CORRECTIVE ACTION
1. Excessive chucking shoe wear. (Observed during daily machine inspection.)	a. Stopping feed before collet fully closed. Poor operator technique. b. Collet adjusted too tight, causing excessive pressure during closing. c. Oversize stock preventing complete collet closing. d. Finger holders not operating properly, preventing complete collet closing. e. Rough or bent finger holder chucking spool. f. Insufficient lubrication to chucking shoe.	a. Be sure collet is closed before stopping machine. b. Loosen collet setting if too tight. c. Replace oversize stock. d. Repair finger holders. e. Repair or replace finger holder chucking spool. f. Repair lubrication line.
2. Cycle time too slow. Reduces production rate. (Observed when checking cycle with a stop watch.)	a. Low speed cam set too early. b. High speed cam set too late. c. Feed clutch or high speed clutch slipping. d. Brake cam incorrectly set. e. Excessive brake tension. f. Loose large worm wheel friction plate. g. Loose V-belt. h. Incorrect spindle speed or feed change gears. Incorrect spindle speed or feed range gears (new setup only).	a. Reset low speed cam. b. Reset high speed cam. c. Adjust or repair feed clutch or high speed clutch. d. Reset brake cam. e. Reset brake band adjusting nuts. f. Readjust large worm wheel friction plate. g. Adjust belt tension. h. Check against gear chart and install correct gears.
3. Cycle time too fast. Can cause tool breakage, excessive tool wear, or rejected parts. (Observed when checking cycle with a stop watch.)	a. Low brake tension or incorrect cam location. b. Low speed cam set too late. c. High speed cam set too early. d. Incorrect spindle speed or feed change gears. Incorrect spindle speed or feed range gears (new setup only).	a. Adjust brake tension or reset brake cam. b. Reset low speed cam. c. Reset high speed cam. d. Check against gear chart and install correct gears.
4. Stock does not feed. [Also see "Defect—Parts Too Short (One or More Spindles)" on page G-5.]	a. Collet does not open because of dirt and/or chip accumulation. b. Collet does not open because of worn collet seat. c. Collet does not open because of impregnated brass or aluminum in collet seating surfaces. d. Collet does not open because of malfunctioning finger holder. e. Stock feed bounces.	a. Clean collet and collet tube. b. Replace collet, collet seat, or both. c. Clean or flash chrome collet seating surfaces. d. Repair finger holder. e. Reduce stock feed cam length.
5. Main drum shaft stops rotating.	a. Feed clutch slipping. b High speed clutch slipping. c. Roll clutch failure. d. Large worm wheel slipping.	a. Adjust feed clutch. b. Adjust high speed clutch. c. Replace roll clutch. d. Adjust large worm wheel.
6. Entire machine stops but main drive motor keeps running.	a. Broken shear pins in pulley drive.	a. Correct cause of problem and replace shear pins.
7. Machine stalls during index.	a. Machine not level. b. Stock reel out of line.	a. Level machine. b. Align stock reel.
8. Spindle carrier does not lock after index.	a. Broken locking pin spring.	a. Replace locking pin spring.
9. High speed clutch not releasing properly.	a. Lubricating oil too heavy. b. Lubricating oil contaminated. c. Worn or broken clutch components.	a. Replace lubricating oil. (See Maintenance, section F, page 3.) b. Flush machine and replace lubricating oil. c. Replace worn or broken parts.

Out-of-Tolerance Parts

Out-of-tolerance parts can be caused by one or more of the following factors:

- External Problems

  Incorrect bar stock, hardness variation, poor bar machinability

  Incorrect selection of spindle speed, feed, tooling or coolant

  Incorrect tool grade, sharpening, tool geometry or chip accumulation

- Machine Problems

  Machine not level

  Dirt accumulation

  Worn or misadjusted clutch and/or brake

  Worn or broken machine parts

  Use of nonapproved replacement parts

- Incorrect Setup

  Wrong size or adjustment of changeable setup items including gears, collets, pushers, tooling, cams, etc.

  Components of previous setup not changed

  Insufficient stock left for subsequent machining

A four-step procedure to troubleshoot out-of-tolerance production is as follows:

1. Determine when the problem started.
2. Determine the quantity and type of defects.
3. Determine the occurrence pattern of the defects.
4. Locate the troubles and possible causes in the troubleshooting chart starting on page G-5.

Step 1: Determine When the Problem Started

If the problem started immediately after setup, check for "External Problems" as follows:

> Be sure the bar stock, spindle speed, feed, coolant, and tooling conform to the job specifications. Correcting any "External Problems" should solve the trouble. Note: A new or changed job could require further engineering to achieve satisfactory production.

If the problem started immediately after setup, check for "Setup Errors" as follows:

> Check the setup. If correcting any apparent "Setup Errors" does not eliminate the trouble, proceed thru Steps 2, 3 and 4 paying particular attention to the setup causes listed in the chart, Step 4.

If the problem started during a satisfactory production run, check any action taken just before the trouble started. For example:

> Loaded new bars — check bar grade, size and straightness.
>
> Changed tools — check tool grade, sharpening, adjustment, amount of material removed, center height, tools installed correctly and correct style of inserts.
>
> Any adjustments

Then proceed thru Steps 2, 3 and 4.

Step 2: Determine the Quantity and Type of Defects

Determine if there is only one or more than one defect on the out-of-tolerance parts.

Classify the defect. Some possibilities include:

1. Length variation
2. Lack of concentricity
3. Variation in formed dimensions
4. Poor surface finish or chatter

Note this information and proceed to Step 3.

Step 3: Determine the Occurrence Pattern of Defects

If all production parts are out-of-tolerance, proceed to Step 4.

If only some are out-of-tolerance, look for an occurrence pattern as follows:

1. Run parts collecting two or three parts from each spindle. (Spindles are identified by numbers stamped on the face of the carrier.)
2. If all the defective parts come from the same spindle, proceed with Step 4 paying particular attention to spindle problems and causes listed in the chart.
3. If the occurrence of defective parts appears to be random, collect several more parts from each spindle. Plot a graph of the occurrence of defects to see if a pattern exists. A pattern can be an important clue to the source of the trouble.

Step 4: Locate the Troubles and Causes

Using the information gathered in Steps 1, 2 and 3:

1. Locate the "Defect" in the following chart.
2. Determine the "Problem" and "Cause" under the "Defect" that best describes the condition.
3. After identifying all of the Defects, Problems, and Causes; begin applying the "Corrective Action."

PROBLEM	CAUSE	CORRECTIVE ACTION
DEFECT — PARTS TOO LONG (All Spindles)		
Setup error.	a. Incorrectly set stock feed stop. b. Misadjusted facing tool or cutoff tool.	a. Reset stock feed stop. b. Readjust facing or cutoff tool.
DEFECT — ERRATIC OR VARYING LENGTH BETWEEN PARTS		
Excessive spindle carrier end play.	a. Long term wear.	a. Adjust spindle carrier end play as detailed on page F-13.
Worn spindle bearing.	a. Long term wear (one, several or all spindles).	a. Replace spindle bearing. Experienced mechanic may be able to readjust.
DEFECT — PARTS TOO SHORT (All Spindles)		
Setup error.	a. Incorrectly set stock feed stop. b. Misadjusted facing or cutoff tool. c. Stock feed cam too short. d. Stock feed cam too long. Stock bounces off stop. e. Insufficient stock feed spring pressure.	a. Reset stock feed stop. b. Readjust facing or cutoff tool. c. Replace stock feed cam. d. Replace stock feed cam. e. Readjust stock feed spring pressure
DEFECT — PARTS TOO SHORT (One or More Spindles)		
Short feed out. Bar does not reach stock stop.	a. Inadequate pusher gripping force. b. Oversize pusher. c. Bent or oversize bar. d. Stock feed cam too short. e. Insufficient stock feed spring pressure.	a. Adjust pusher tension or replace pusher. b. Replace pusher. c. Replace bar. d. Replace stock feed cam. e. Readjust stock feed spring pressure.
Stock pushing back into collet.	a. Collet improperly adjusted. b. Oversize collet. c. Worn or broken collet or collet seat. d. Undersize stock. e. Excessive end pressure from dull tools. f. End tools hitting work at high speed.	a. Readjust collet. b. Replace collet. c. Replace collet or collet seat. d. Replace undersize bars. e. Replace dull tools. f. See Malfunction 3 on page G-3.
DEFECT — POOR CONCENTRICITY (Consistent Error on All Output Parts)		
Setup error.	a. Misaligned tool. b. Wrong tool. c. Improperly set slides. d. Poor rigidity of part. e. Incorrect tooling sequence.	a. Readjust tool. b. Replace tool, change style of tool to correct concentricity. c. Reset slides. d. Rearrange or redesign tooling. e. Rearrange or redesign tooling.
DEFECT — POOR CONCENTRICITY (Varies Part-to-Part)		
Excessive side pressure.	a. Dull or chipped tool. b. Excessive feed.	a. Replace tool. b. Consider need for side pressure support or reduce feed.
Incorrect tool.	a. Wrong style or grind of tool. b. Tool deflection.	a. Replace or alter tool grind. b. Reduce tool overhang or change grind.
Faulty slide system.	a. Worn slide components.	a. Refit or replace slide components as needed.
Wobble in spindle.	a. Worn spindle bearings.	a. Replace spindle bearings. Experienced mechanic may be able to readjust.
Defective collet.	a. Loose collet. b. Worn collet. c. Eccentric collet.	a. Adjust collet. b. Replace collet. c. Replace collet.

PROBLEM	CAUSE	CORRECTIVE ACTION
DEFECT — INCORRECT FORMED DIMENSION (Consistent Error on All Output Parts)		
Setup error.	a. Improper tool. b. Improperly adjusted gibs. c. Incorrectly set stop screws. d. Insufficient cleanup stock.	a. Replace tool. b. Check for dirt accumulation preventing proper setting. Clean and reset. c. Reset stop screws. d. Reset roughing tool.
DEFECT — VARIATIONS IN FORMED DIMENSIONS (Vary Part-to-Part)		
Faulty cross slide operation.	a. Worn cross slide components. b. Accumulated chips occasionally prevent full slide motion. c. Loose cross slide cams.	a. Replace or readjust cross slide components. b. Rearrange tools so chips can't accumulate. c. Tighten cams as needed.
Excessive side pressure.	a. Tool above center. b. Worn or chipped tools. c. Excessive feed. d. Varying feed rate.	a. Readjust tool. b. Replace poor tools. c. Consider need for side pressure support or reduce feed. d. Correct erratic feed motion.
Bar stock vibration.	a. Incorrect spool bushings. b. Bent bar stock. c. Dry bar stock.	a. Replace spool bushings. b. Replace bar stock. c. Lubricate bar stock generously.
Tool vibration (also causes chatter, poor surface finish and short tool life).	a. Tool below center. b. Worn or loose tool holding device. c. Cut too wide. d. Insufficient tool support. e. Insufficient work support. f. Loose collet. g. Insufficient bar stock support. h. Loose gibs, rollers, roll blocks or cams. i. End play in cross slide shaft.	a. Readjust tool. b. Tighten or replace tool holding device. c. Reduce tool width. d. Add necessary tool support. e. Add necessary work support. f. Readjust collet. g. Add bar stock support. h. Tighten or replace as needed. i. Remove end play.
Spindle wobble.	a. Worn spindle bearings (one or more spindles).	a. Replace spindle bearings. Experienced mechanic may be able to readjust.

SPECIAL NOTE: When a job gets so far out of control that problems are difficult to analyze or each solution creates another problem, it is time to start from the beginning. First check for any external problems and recheck every setup detail. When you positively eliminate the possibility of external or setup errors, analyze the production run as follows:

1. Remove the chuck opening cam and block the feed slide. Run the machine until all pieces are cut off.
2. Feed out one piece manually.
3. Run this piece thru the first position. Stop the machine and examine the part. Do not change any adjustments.
4. Repeat the third step above for all positions. Keep notes on the results at each position.
5. When more than one tool operates at a position, check to see if one tool influences the accuracy of another. For example, side pressure from a forming tool can cause a drill to cut oversize or off center. If this problem is suspected, remove the offending tool, run the part thru the position and note the results.
6. An accurate list of when and how defects occur will help locate the troubles and causes so they can be solved.

SECTION H: APPENDIX
Table of Contents

Setting Adjustable Stock Feed 2
Changing Spindle and Feed Gears 5
  Gear Change Steps for Machines where the Spindle Speed Change Gears are Located at the Motor End and the Feed Change Gears are Located in a Box on the Front Side of the Machine 5
    Remove Spindle Speed Change Gears 5
    Replace Range Gears 5
    Replace Spindle Speed Change Gears 5
    Replace Feed Change Gears 6
  Gear Change Steps for Machines where the Spindle Speed Change and Feed Change Gears are Located inside the Gearbox and the Spindle Speed Range and Feed Range Gears are Located on the Motor End 6
    Replace Change Gears 6
    Replace Range Gears 7
Setting a Cutoff Tool on Center 8
Carrier Stop Screws 9
Two-Piece End Toolslide Cams 10
How to Order Threading Cams 11
How to Order Reaming Cams 11
Production Formula (Cycle Time) 11
Stock Depletion System 12
  Style B: Non-adjustable Pressure Switch (starting 1979) 13
  Style A: Adjustable Pressure Switch (prior to 1979) 13
Disc Plate Style Brake ($^7/_{16}$" RA-6) 14
Supplemental Air Cylinder Brake ($^5/_8$" RN-6) 14
Ratcheting Style Slip Clutch 15
Air Line Lubricants 16
Machine Cutting and Lubricating Oil Publications 16
Air Supply Volume 16
Electrical Codes and Standards 16
Spindle Positions 17

Setting Adjustable Stock Feed

(Standard equipment on 1" RAN-6; optional on all other models)

When a machine is equipped with this mechanism, stock feed-out length can be quickly and easily obtained by a simple travel adjustment on a single cam. This eliminates the need for more than one cam and allows increments of total stock feed-out to be used.

Machines are set at the factory with the *quadrant cam roll* at the high point of the cam coinciding with "0" on the *feed setting scale.* (Fig. H-1)

On machines equipped with spindle stopping and adjustable stock feed, the *quadrant lever* uses rear fulcrum hole "A" and a different bracket for the *rear lever.*

Length of the stock feed-out that will be required is based on length of part and allowances needed to produce the piece using the following procedure.

EXAMPLE: 4" long part on a 1" RAN-6 machine

Length of part	4"
Width of cut-off	3/32"
Facing allowance	1/64"
Pusher tube roll and shoe clearance 1/8" plus 1/16" extra	3/16"
Collet pinch point loss allowance (Refer to Table H-1)	1/8"
(Total) Pointer setting on scale	4 27/64"

Table H-1. Collet Pinch Point Loss

Length of Stock Feed-Out	Collet Pinch Point Loss Dimension "A" (See Fig. H-2.)
0" to 1"	1/32"
1" to 2"	1/16"
2" to 3"	3/32"
3" to 4"	1/8"
4" to 5"	5/32"

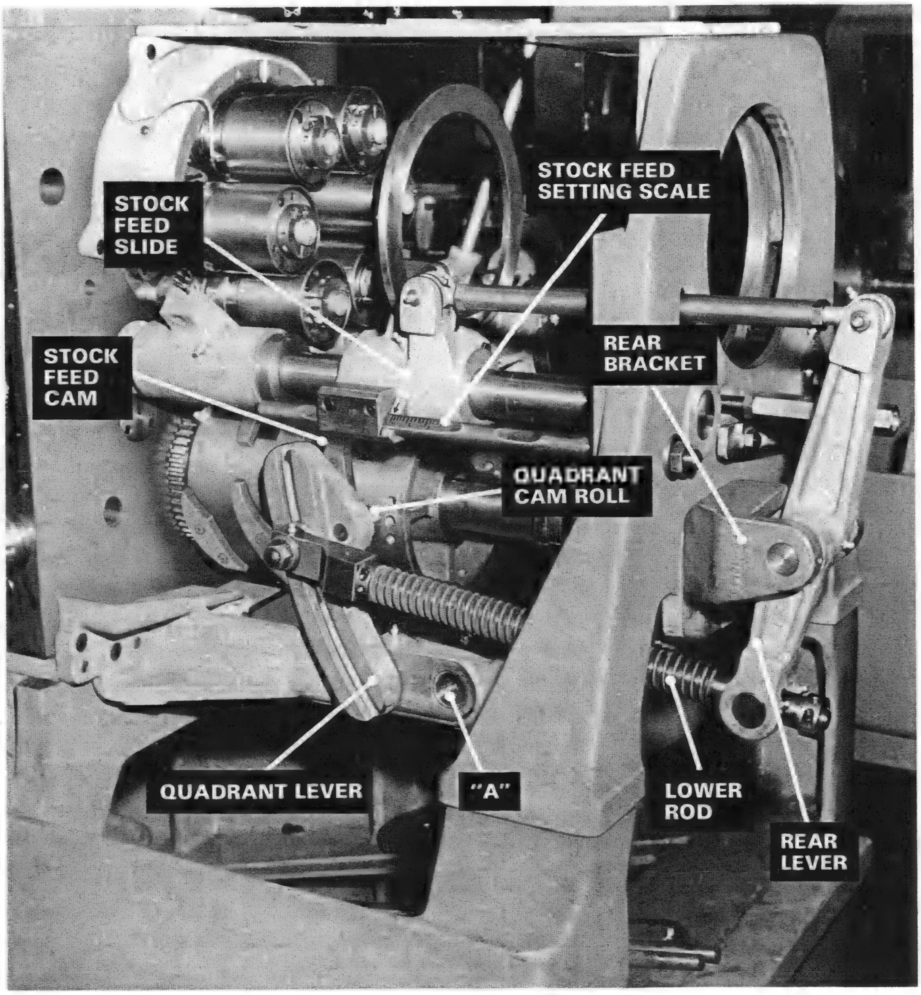

STOCK FEED SLIDE
STOCK FEED SETTING SCALE
STOCK FEED CAM
REAR BRACKET
QUADRANT CAM ROLL
QUADRANT LEVER
"A"
LOWER ROD
REAR LEVER

Fig. H-1. Components of the adjustable stock feed.

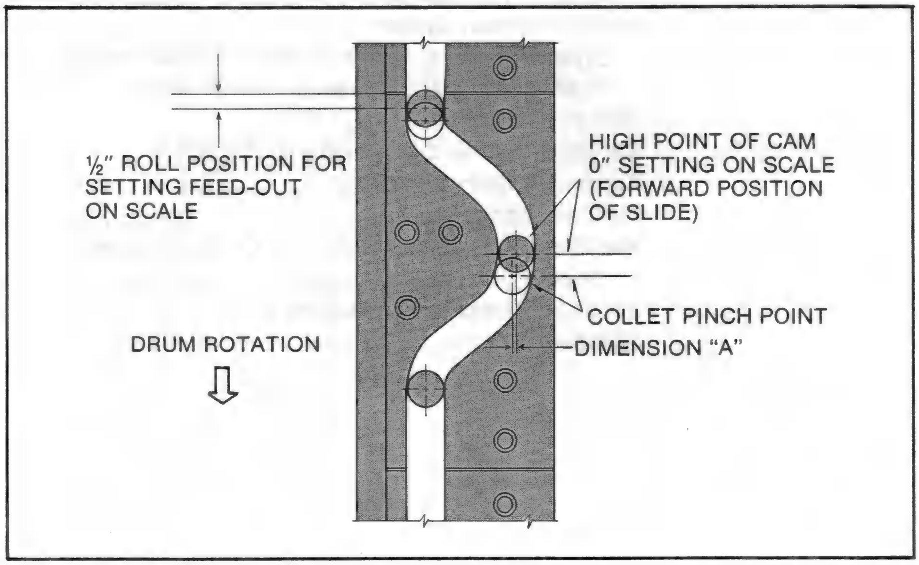

½" ROLL POSITION FOR SETTING FEED-OUT ON SCALE
HIGH POINT OF CAM 0" SETTING ON SCALE (FORWARD POSITION OF SLIDE)
COLLET PINCH POINT
DIMENSION "A"
DRUM ROTATION

Fig. H-2. Stock feed cam dimensions.

Locate the *quadrant cam roll* at high point of the *cam* and be sure that the pointer is at 0" on the *setting scale.* Jog or crank the machine to rotate the *drum* until the *cam roll* is located approximately ½" below the end of *cam.* (Fig. H-3) Loosen nut on the *quadrant lever block* to permit moving the *block* in the *quadrant lever slot.* Movement of the *block* is transmitted thru the *rod, lever* and *link* allowing the *stock feed slide* to be moved to where its pointer is at the scale setting for the desired length of feed-out. Tighten *nut* on *block.*

Crank the machine until the *stock feed slide roll* is in line with the highest point of the *stock feed return cam.* (Fig. H-3)

Position the *aligning disc assembly* over the ends of the *pusher tubes* until the *wear plate* on the *guard disc* makes contact with the *pusher tube spools.* Position the *aligning disc assembly* to allow a minimum of ⅛-inch clearance between the *wear plate* and the *pusher tube spool* to permit free rotation of the pusher tubes. (Fig. H-4) Tighten the *aligning disc positioning screw.*

Check operation by jogging or cranking the machine.

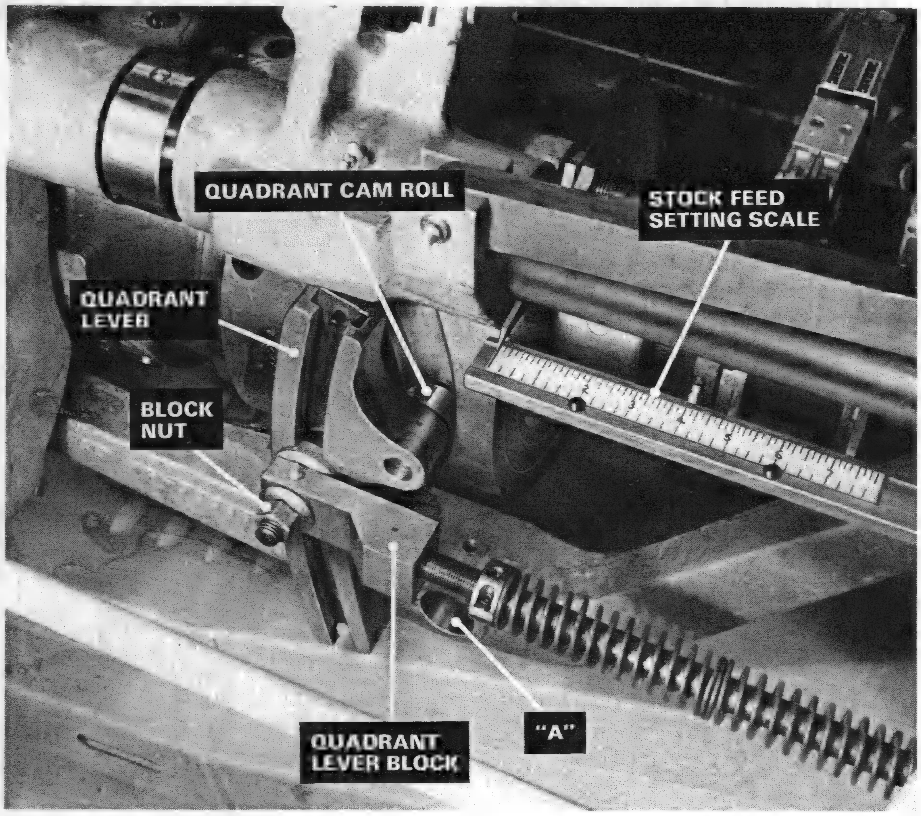

QUADRANT CAM ROLL
STOCK FEED SETTING SCALE
QUADRANT LEVER
BLOCK NUT
QUADRANT LEVER BLOCK
"A"

Fig. H-3. Setting cam roll.

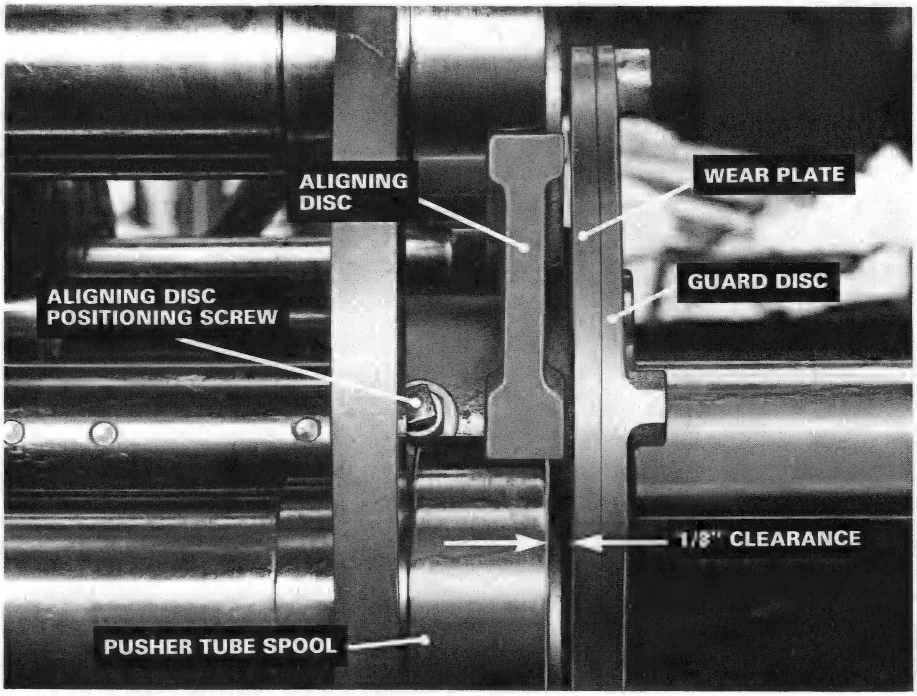

ALIGNING DISC
WEAR PLATE
GUARD DISC
ALIGNING DISC POSITIONING SCREW
1/8" CLEARANCE
PUSHER TUBE SPOOL

Fig. H-4. Position aligning disc assembly to allow ⅛-inch minimum clearance.

An adjustable *long safety nut* and *locking lever* mounted on *rear stock reel support* is used to prevent the *stock feed slide* from moving forward. (Fig. H-5) To properly locate the *long safety nut,* move the *slide* back (set at the desired length of stock feed) and swing the *locking lever* up into position. Move the *long safety nut* and *hex jam nut,* allowing 1/32-inch clearance between *nut* and *locking lever.* Lock nuts.

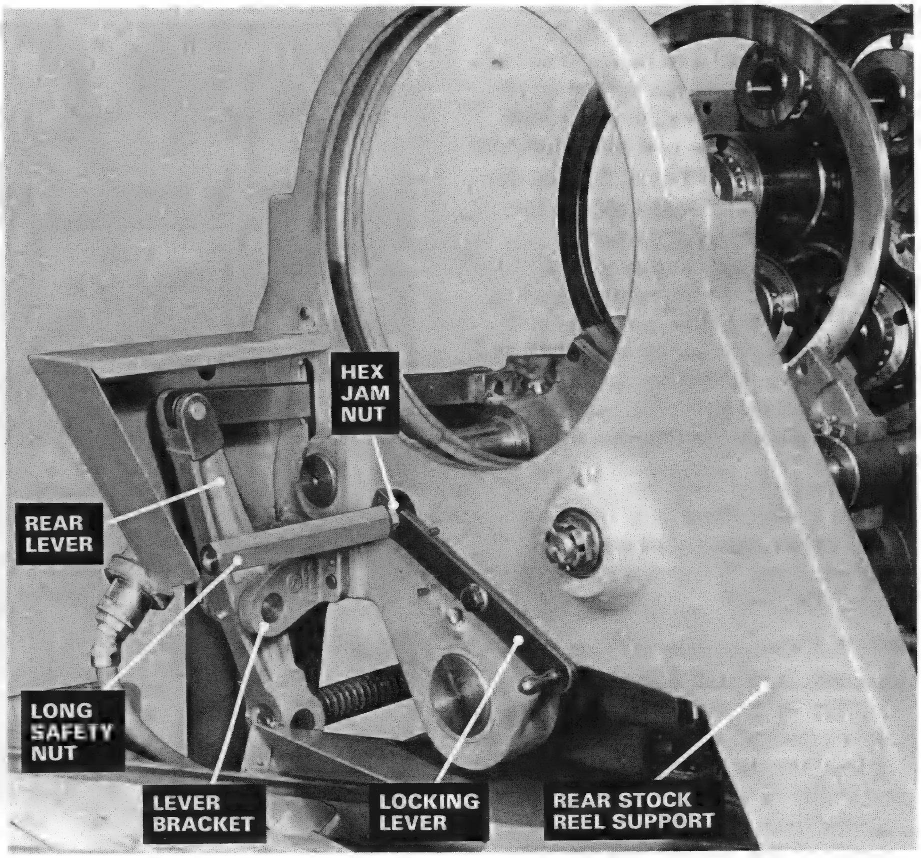

HEX JAM NUT
REAR LEVER
LONG SAFETY NUT
LEVER BRACKET
LOCKING LEVER
REAR STOCK REEL SUPPORT

Fig. H-5. Mechanism to prevent stock feed slide from moving forward.

Changing Spindle and Feed Gears

Gear Change Steps for Machines where the Spindle Speed Change Gears are Located at the Motor End and the Feed Change Gears are Located in a Box on the Front Side of the Machine (1¼" RA-6 and ¾" RA-8)

Remove Spindle Speed Change Gears

Remove the two sets of cap screws, lock washers and large washers. Remove the two *spindle speed change gears.* (Fig. H-6)

> NOTE: The spindle speed change gears labeled K and L in photo correspond to the gear designations on the gear chart for the 1¼" RA-6 machine only. With a ¾" RA-8 machine, these gears are designated A and B.

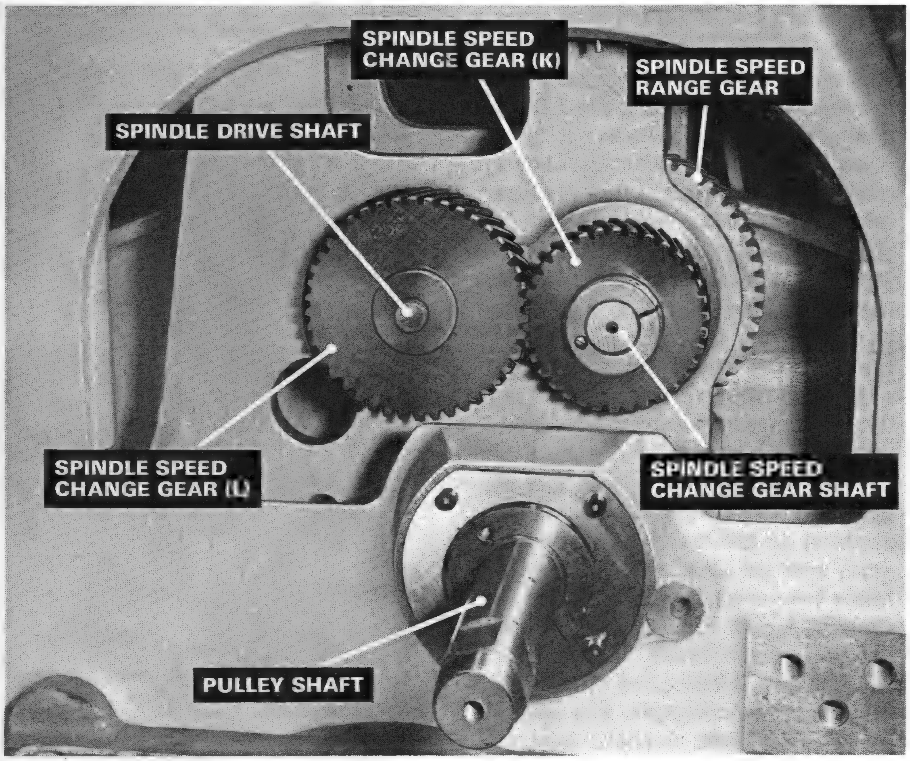

SPINDLE SPEED CHANGE GEAR (K)
SPINDLE SPEED RANGE GEAR
SPINDLE DRIVE SHAFT
SPINDLE SPEED CHANGE GEAR (L)
SPINDLE SPEED CHANGE GEAR SHAFT
PULLEY SHAFT

Fig. H-6. Remove spindle speed change gears.

Replace Range Gears

Unscrew the *split nut* located next to the bearing in gearbox. (Fig. H-7) Slide the *spindle speed change gear shaft* toward the carrier until the *range gear* can be removed. Replace with proper *range gear.* Slide the *spindle speed change gear shaft* back into position and screw the *split nut* back into place. Adjust the *split nut* to put a light pressure on the tapered bearing so the shaft can turn freely with no end play.

Replace Spindle Speed Change Gears

Place the correct *spindle speed change driver gear* on the right-hand shaft and replace the large washer, lock washer and cap screw. (Fig. H-6)

Place the correct *spindle speed change driven gear* on the left-hand shaft and replace the large washer, lock washer and cap screw.

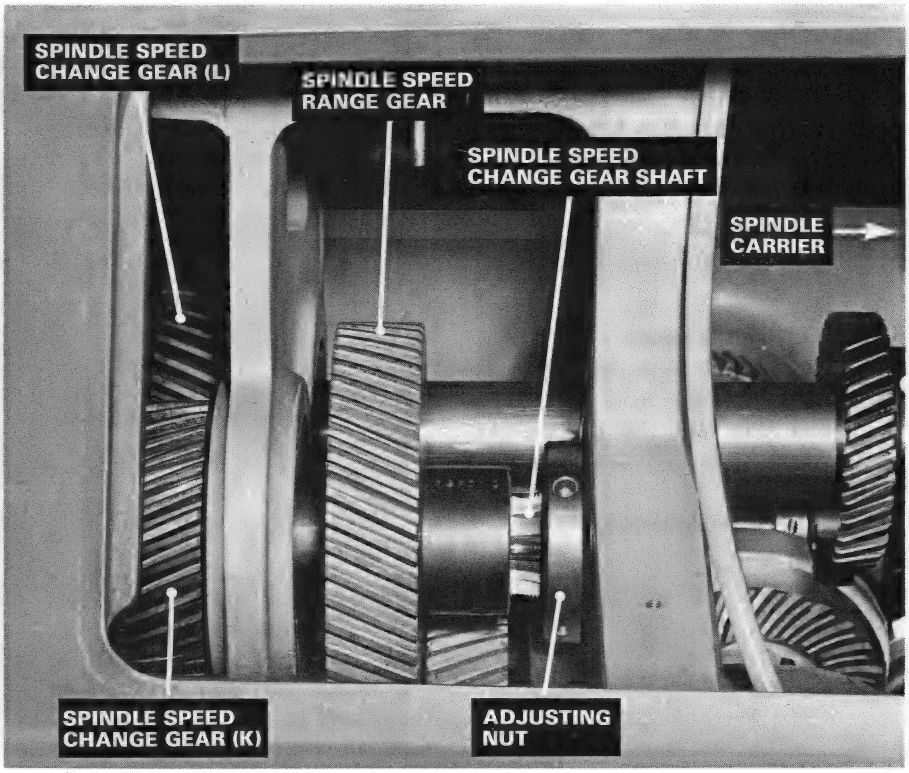

SPINDLE SPEED CHANGE GEAR (L)
SPINDLE SPEED RANGE GEAR
SPINDLE SPEED CHANGE GEAR SHAFT
SPINDLE CARRIER →
SPINDLE SPEED CHANGE GEAR (K)
ADJUSTING NUT

Fig. H-7. Replace range gear.

Replace Feed Change Gears

Remove the cap screws, lock washers and large flat washers from the *feed worm shaft* and *feed change gear stud.* (Fig. H-8) Remove the drive collar and the four feed change gears. Refer to the appropriate gear chart for 1¼" RA machine for specifications of gears A, B, C and D. (On a ¾" RA-8 machine, these gears are designated C, D, E and F.) Place *gear D* on the *feed worm shaft* with the two drive pins engaged with the *roll clutch housing.* Place *gear C* on the bronze bushing on the *feed change gear stud,* with the pin in the bronze bushing engaging a hole in *gear C.* Place *gear B* on the bronze bushing on the *feed change gear stud,* with the two driving pins in holes between *gears B* and *C* so they drive as a unit. Place *gear A* on the *feed worm gear shaft,* and then drive collar with the two drive pins in holes between the drive collar and *gear A.* Replace the large washers, lock washers and cap screws. The small pin in the large washer on the end of the *feed change gear stud* must engage the hole in the *feed change gear stud.*

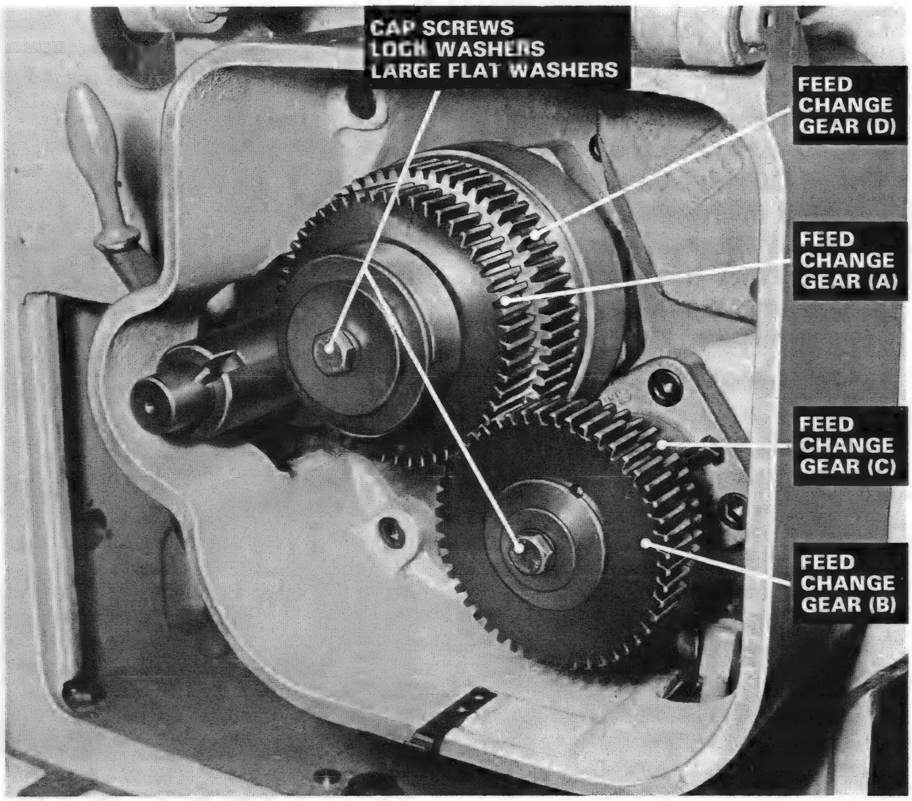


Fig. H-8. Replace feed change gears.

Gear Change Steps for Machines where the Spindle Speed Change and Feed Change Gears are Located inside the Gearbox and the Spindle Speed Range and Feed Range Gears are Located on the Motor End (7/16" RA-6)

Replace Change Gears

Spindle speed change gears are accessible from the back side of the machine. (Fig. H-9) Remove the two sets of cap screws, lock washers and large washers. Remove the two *spindle speed change gears.*

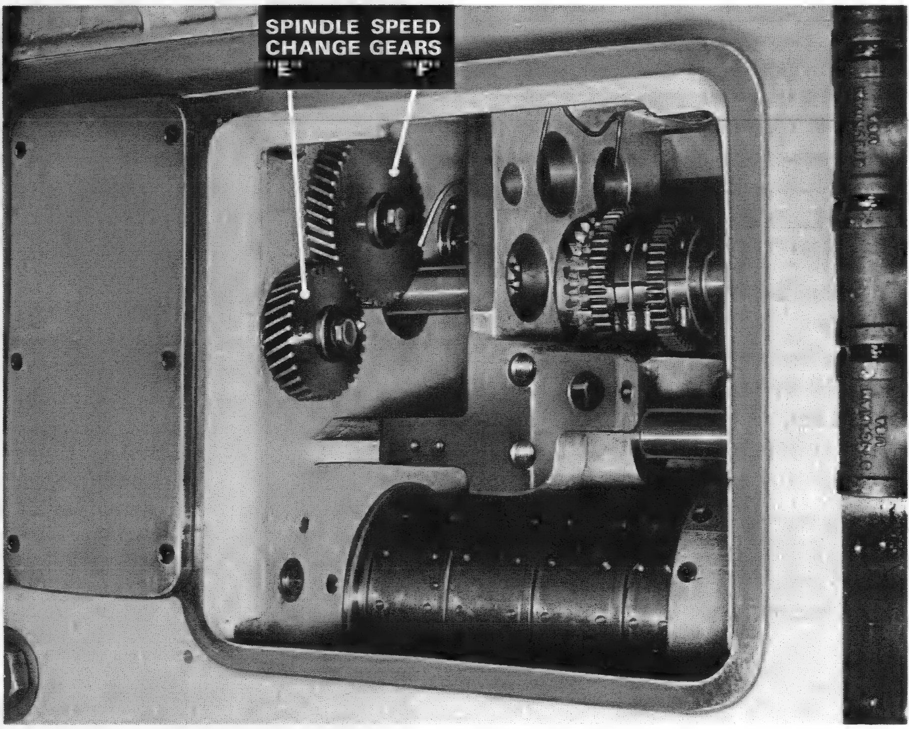


Fig. H-9. Spindle speed change gears are accessible from back side of machine.

Feed change gears are accessible from the front side of the machine. (Fig. H-10) Remove the two sets of cap screws, lock washers and large washers. Remove the two *feed change gears.*

Place the correct *spindle speed change driver gear* on the outside shaft and the correct *spindle speed change driven gear* on the inside shaft. Replace the large washers, lock washers and cap screws.

Place the correct *feed change driver gear* on the inside shaft and the correct *feed change driven gear* on the outside shaft. Replace the large washers, lock washers and cap screws.

Replace Range Gears

Remove the three sets of cap screws, lock washers and large washers. (Fig. H-11) Remove the four *range gears.* Refer to Tooling Setup Chart for correct gears and use appropriate gear chart to determine location of gears.

Place the correct *spindle speed range driver gear* on the right-hand shaft and the correct *spindle speed range driven gear* on the center shaft. Place the correct *feed range driver gear* on the center shaft (on top of the spindle speed range driven gear) and the correct *feed range driven gear* on the left-hand shaft.

Replace the three large flat washers making sure the lock pin is engaged in the hole on each shaft. Replace lock washers and cap screws.

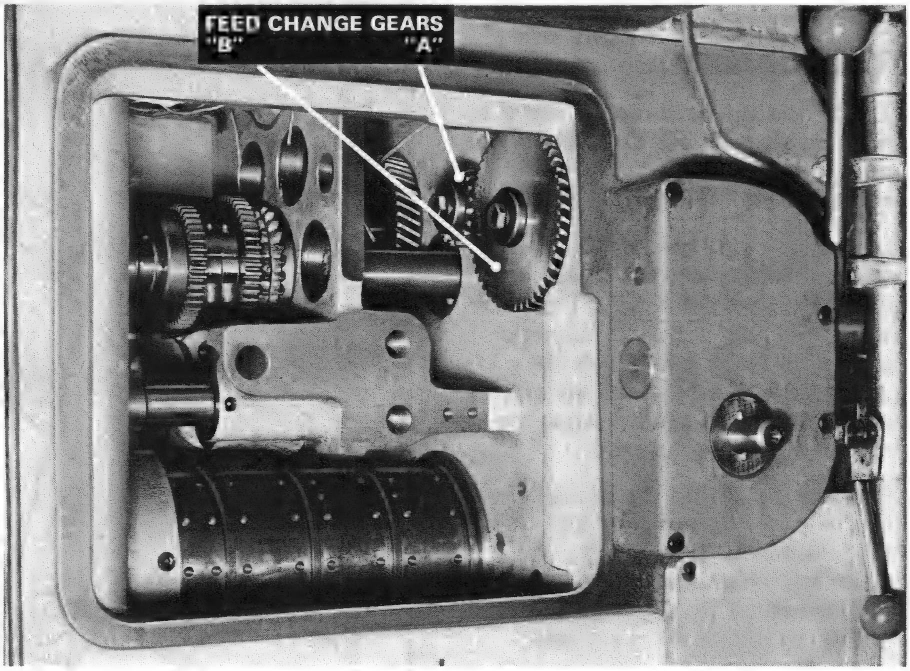


Fig. H-10. Feed change gears are accessible from front side of machine.

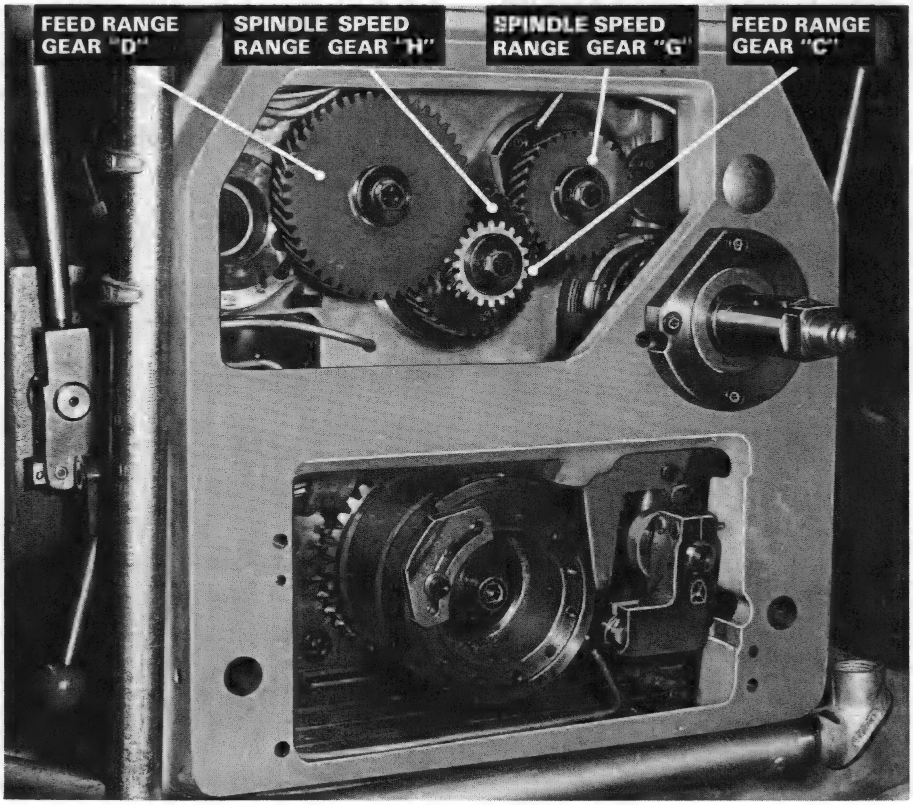


Fig. H-11. Range gears are located on motor end.

Setting a Cutoff Tool on Center

This procedure requires the use of a solid test bar. If your setup bar is not solid, replace it temporarily with a short butt end of a solid bar.

Mount the *cutoff toolholder and blade assembly* into the *cross slide* so that the bottom edge of the blade will cut slightly above the center of the test bar (Fig. H-12) and the leading edge of the blade will reach the center of the test bar when the machine is at high point.

Position the test bar so the *cutoff tool* will only make a light cut (approximately 1/16 inch). Jog the machine to high point to make the first test cut. Then jog the machine in reverse to retract the *cutoff tool.*

This cut will leave a small nib at the center of the test bar. Measure the diameter of the nib with calipers or a micrometer. Take one-half of this measurement and lower the *cutoff toolholder and blade assembly* in the *cross slide* that distance.

Make a second test cut. If a clean cut is made without leaving a nib or galled surface at the center of the test bar, the *cutoff tool* is on center. If a small nib remains, the *tool* is still above center. If a galled surface shows at the center of the test bar, the *tool* is below center. Adjust the *tool* up or down as necessary.

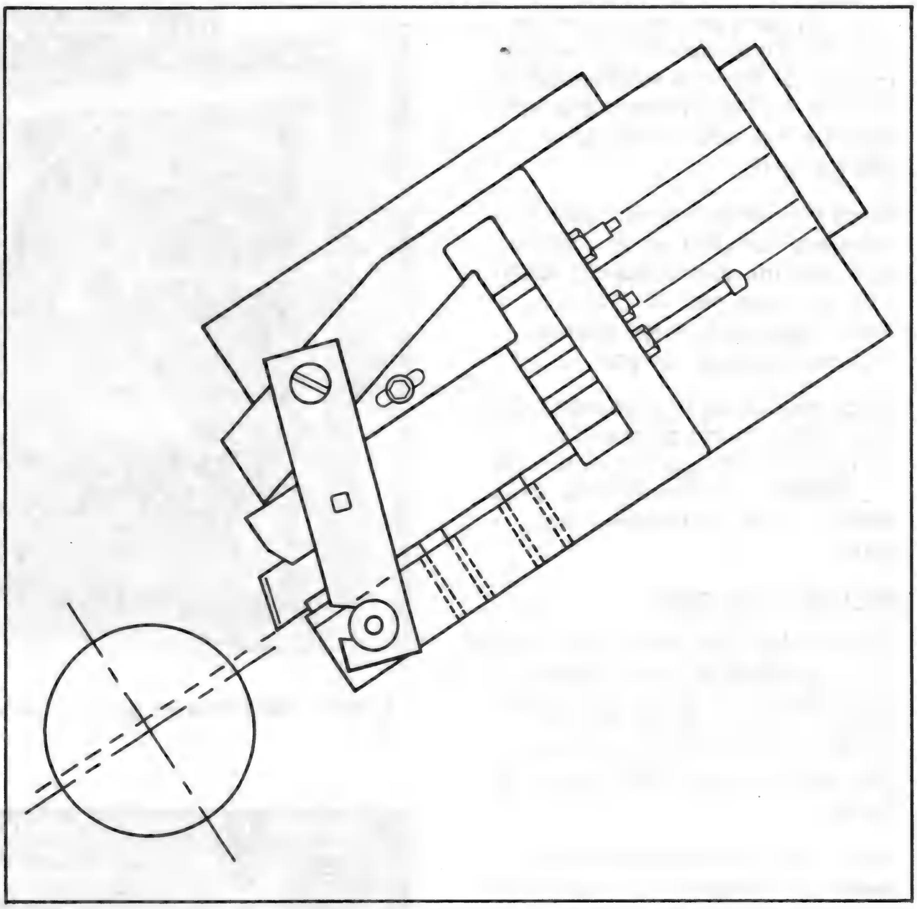


Fig. H-12. Position cutoff blade to cut above center of test bar.

Carrier Stop Screws

Carrier stop screws are set at the factory. If an excessive variation in size occurs between successive spindles at any one cross slide position, it may be necessary to adjust that carrier stop screw on the spindle carrier to compensate for any wear. They should not be disturbed in normal operation of the machine or even when changing setup. Before any adjustments are made to them, careful analysis of the specific problem should be evaluated to be certain that they are not moved unnecessarily.

Carrier stop screws are set at the factory as follows:

1. Back off cross slide stop screw.
2. Mount a dial indicator on the cross slide using a stationary part of the machine as the operating point. (Fig. H-13)
3. Jog the machine to a point where the indicator stops moving. (This indicates high point of cam.) Set indicator at zero.
4. Advance the cross slide stop screw to within 0.015" of the carrier stop screw. Use a 0.015" feeler gage to check the distance. (It is good practice to keep the carrier stop screws positioned as short as possible.)
5. Index the carrier to the next spindle.
6. Jog machine to high point. Dial indicator will read zero.
7. Use the 0.015" feeler gage between the cross slide stop screw and the carrier stop screw. Adjust the carrier stop screw as necessary to contact the feeler gage.
8. Continue Steps 5 thru 7 until all the carrier stop screws are adjusted to the exact same setting for that slide.
9. With slide on high point, adjust the cross slide stop screw to give 0.005" to 0.0075" stop pressure. Reset dial indicator to zero.
10. Run the machine, indexing the carrier so that each spindle can be checked for accuracy. Dial indicator must read zero for all spindles at high point. Readjust carrier stop screws if necessary. Repeat Steps 1 thru 10 for all remaining cross slides.

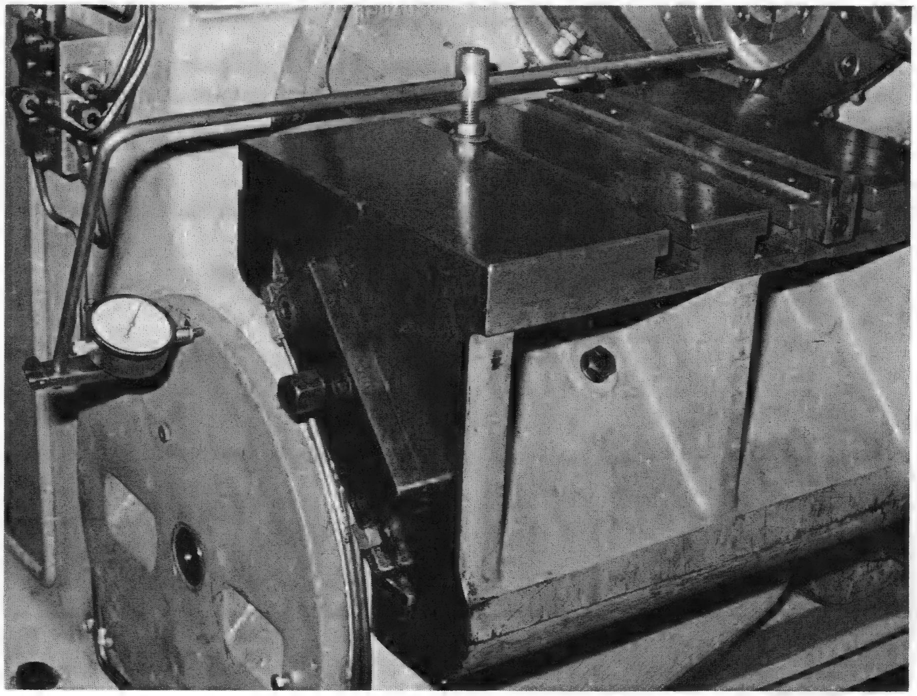
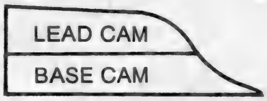


Fig. H-13. Use dial indicator to set carrier stop screws.

Two-Piece End Toolslide Cams

When full return end toolslide cams are used, the end toolslide lead cam is furnished as a two-piece cam up to and including the leads shown in Table H-2.

Table H-2. Machine Sizes and Maximum Leads for End Toolslide Lead Cams.

Machine Size	 Range of leads on two-piece cams	 Range of leads on one-piece cams
1¼" RB-8 1⅝" RB-6 1⅝" RBN-8 2" RB-6 2⅝" RBC-4	0" thru 2"	$2\frac{1}{16}$" thru 7"
1⅝" RB-8 2" RB-8 2⅝" RB-6 2⅝" RB-8 3½" RB-4 3½" RB-6 3½" RB-8 4" RB-6 4½" BRG-4 4½" RBT-4 5½" RB-4 5½" RBT-4	0" thru $2\frac{15}{16}$"	3" thru 8"
4" RB-8 6" RB-6 7¾" RB-4 8" RBN-4	0" thru $1\frac{15}{16}$"	2" thru 6½" (Special leads up to 12" are available)

NOTES:

1. One-piece end toolslide cams are available as substitutes for two-piece cams, when desired, on special order.

2. The base cam and lead cam of a two-piece cam must be removed to install a one-piece cam.

How to Order National Acme Threading Cams

Threading cams for universal and plain threading attachments are now furnished as a two-cam setup: a positive follow-up lead cam and a lead guard cam. Because the lead cam is cut to provide exact follow-up for each specific job, always give complete information when ordering threading cams:

1. Machine size, model and serial number.
2. Position in which attachment is used.
3. Lever hole (upper, center or lower).
4. Threading gear ratios used.
5. Feed gears being used and whether fine or coarse range (give number of gear chart). (Feed per revolution on a 1-inch cam can be substituted for feed gears, range gears and gear chart.)
6. Thread specifications including pitch, length and diameter.
7. If possible, provide print of part and list of operations. (Latter is necessary to determine if threading is to be in cutoff position.)
8. For tapping, specify if tap is to be solid or collapsible type. (If solid tap is used with releasing type holder, give Namco part number of holder or specify distance required to pull off.)
9. Specify whether electric tripping or mechanical clutch tripping is used for universal threading applications (determines whether cam will have a dwell).
   NOTE: When ordering cams that are to operate with existing cams on the machine, it is good practice to furnish their part number or a paper template of them with the order.

How to Order National Acme Reaming Cams

Reaming cams are standard four-cam setup (lead, lead guard, return and return guard) in positions other than cutoff. In cutoff position reaming cams are three-cam setup (return guard is on end of short lead cam). Lead and lead guard cams only are changed for different jobs. The following information should be given when ordering reaming cams:

1. Machine size, model and serial number.
2. Position in which attachment is used.
3. Lever hole used (upper, center or lower).
4. Length to be reamed. If possible, send print of part and list of operations.

Production Formula (Cycle Time)

The time to make a part on a multiple spindle bar machine is called the cycle time and is the sum of the machining time and the idle time.

Machining Time

The machining time (see Section B, pages 12 and 13) is divided into two parts: the actual machining time and the cam dwell time. To calculate the actual machining time, it is necessary to establish the longest single operation which determines the number of work spindle revolutions to make the part.

Knowing the spindle speed (revolutions per minute) and the number of revolutions, the actual machining time can be found by applying the formula: Number of Revolutions Required (N) divided by Revolutions per Minute (RPM) times sixty seconds equals time in seconds for actual machining operation (AMO).

$$\frac{\text{N}}{\text{RPM}} \times 60 = \text{AMO}$$

To provide accuracy in feed rate per revolution, National Acme Gear Charts do not reflect that portion of the cam used for dwell. An empirical peripheral length of dwell is 5° dwell for every 100° of cutting length or a 1 to 20 ratio. Based on this, the time of the dwell can be established as 5% of the machining time or 1 second for each 20 seconds or fraction thereof of the machining time.

Idle Time

Idle time (see Section B, page 13) for each machine size is given in the specification section of the *Acme-Gridley Multiple Spindle Bar Machine Manual Supplement.*

Example

1¼" RA-6 070-2 Gear Chart
¾" Lead at 0.0050, 617 RPM

1. Machining Time

$$\frac{0.750}{0.005} = 150 \text{ Rev.}$$

$$\frac{150}{617} \times 60 = 14.6 \text{ Seconds}$$

$$\frac{14.6}{20} = .7 \text{ Seconds}$$

2. Idle Time (Standard) $= \underline{1.8}$ Seconds

Cycle Time = 17.1 Seconds

Stock Depletion System

The stock depletion device (Fig. H-14) automatically stops the feed and main drive motor of the machine when a bar is fed out short, indicating that the stock is depleted or that one or more pushers are weak. The stock depletion system consists of a mechanically operated stock stop which is linked through pneumatics to the air feed and main drive motor control system. The stock, when fed out against the stock stop button, depresses the stock stop button allowing air to escape to atmosphere. This causes the pressure switch in the electric circuit to fall to normal. At this time, a limit switch on the drum shaft is operated by a bump cam to check the pressure in the system. If the pressure is normal, it indicates a full feed out and the machine continues to cycle. After the stock stop has withdrawn, the pressure switch is re-operated by air. At the end toolslide high point, a second limit switch is operated by a bump cam on the drum shaft to check that the pressure switch has operated. If it has, the machine will continue to cycle.

There are two styles of control systems for the stock depletion mechanism. Style A (prior to 1979) has an adjustable air pressure switch which requires some setting and maintenance to insure proper operation. Style B has a factory preset pressure switch and requires cam setting only. A representative sequence setting for these styles is as follows:

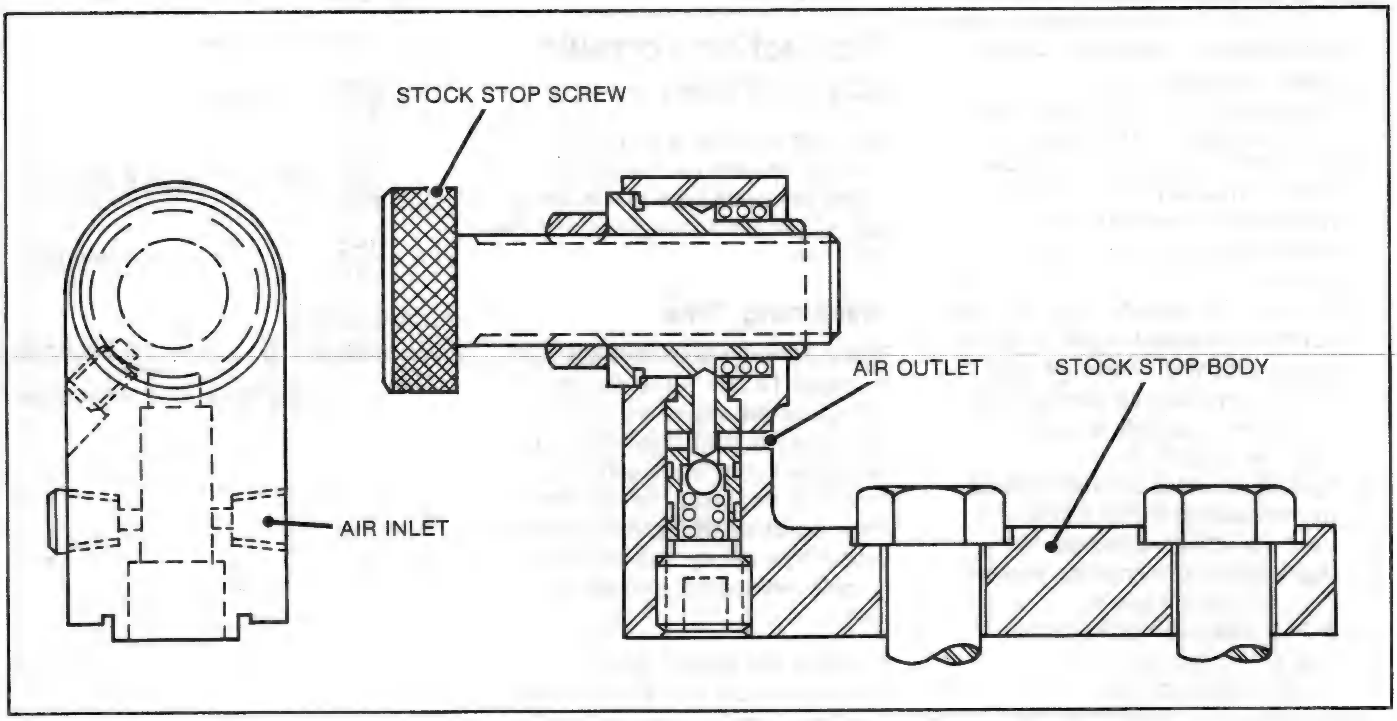


Fig. H-14. Stock depletion stock stop.

Style B: Non-adjustable Pressure Switch (starting 1979)

1. Turn on air and electric power.
2. Set regulator No. 2 at 40 PSI. (Fig. H-15)
3. Set cam to operate 1-LS immediately after feed out. (Fig. H-16)
4. Set cam to operate 2-LS at high point. (Fig. H-16)

For the exact operating sequence for a specific machine, refer to the wiring or pneumatic diagram assigned to it.

Style A: Adjustable Pressure Switch (prior to 1979)

1. Adjust pressure switch setting.
   a. Turn on air and electrical power.
   b. Set regulator No. 2 at 35 PSI.
   c. Make certain 1-LS is not operated by cam. (Fig. H-16)
   d. Make certain 2-LS is operated by cam. (Fig. H-16)
   e. Turn adjusting screw on 2-PS fully counterclockwise. Don't force.
   f. Press Feed Reset button.
   g. With main drive motor OFF, engage feed.
   h. Turn adjusting screw on 2-PS slowly clockwise until feed disengages. Tighten lock nut.
   i. Reset regulator No. 2 at 40 PSI.
2. Set cam to operate 1-LS immediately after feed out. (Fig. H-16)
3. Set cam to operate 2-LS at high point. (Fig. H-16)

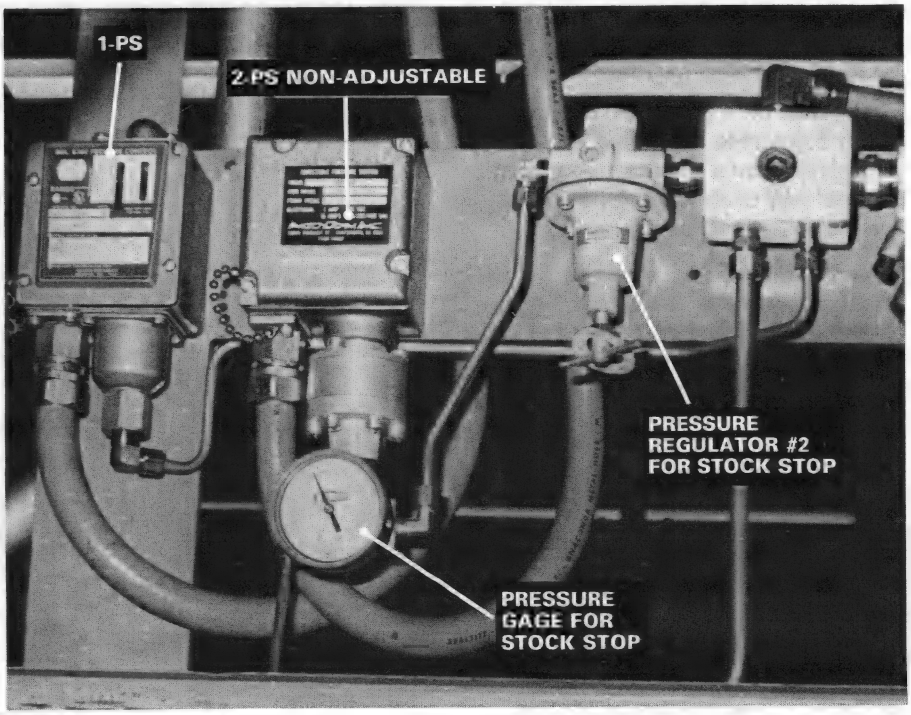

1-PS
2-PS NON-ADJUSTABLE
PRESSURE REGULATOR #2 FOR STOCK STOP
PRESSURE GAGE FOR STOCK STOP

Fig. H-15. Stock depletion controls (mounted on top plate).

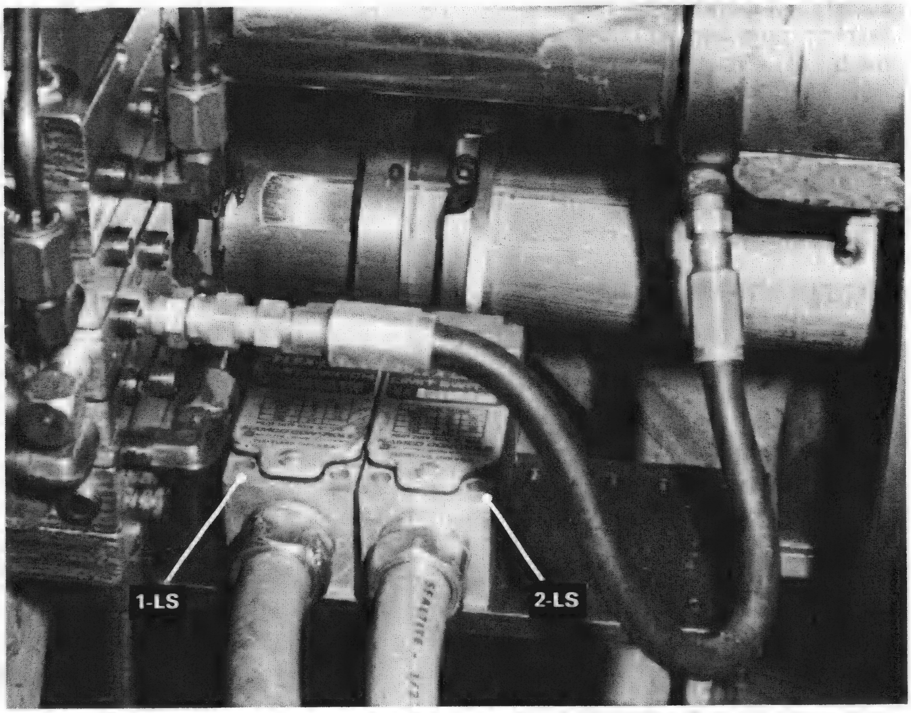


Fig. H-16. Stock depletion controls (mounted in stock feed area).

Disc Plate Style Brake (7/16" RA-6)

The brake on a 7/16" RA-6 machine is a nonadjustable disc plate pack and is operated by a disc cam mounted on the face of the attachment drum on motor end of the machine.

To adjust the brake, crank or run the machine until the roll is in the center of the dwell of the cam. Release lock screw from adjusting sleeve to permit turning of the adjusting sleeve. Turn the adjusting sleeve, compressing snubber until 15 lb-ft (±10%) torque is obtained on the large worm shaft. Lock jam nuts in place on roll carrier to obtain 1/32-inch clearance between nuts and adjusting sleeve. Tighten lock screw to adjusting sleeve. The brake on this machine is also operated when the feed is disengaged manually or by the air cylinder. To set the brake for this action, stop the machine. With the feed clutch disengaged, turn adjusting screw to apply force to the brake operating shoe. Lock adjusting screw in place with jam nut. Engaging the feed will now release the brake.

NOTE: It may be necessary to move the brake bracket closer to or away from the brake shoe to obtain sufficient screw length for adjustment.

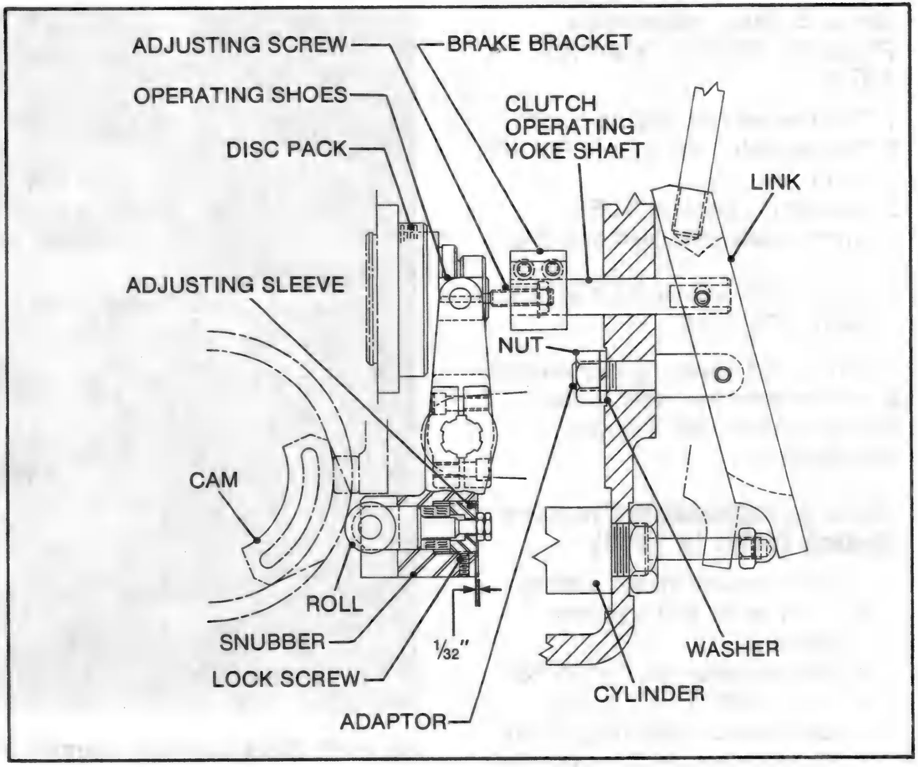

ADJUSTING SCREW
BRAKE BRACKET
OPERATING SHOES
CLUTCH OPERATING YOKE SHAFT
DISC PACK
LINK
ADJUSTING SLEEVE
NUT
CAM
ROLL
SNUBBER
1/32"
LOCK SCREW
WASHER
CYLINDER
ADAPTOR

Fig. H-17. Disc plate style brake.

Supplemental Air Cylinder Brake (5/8" RN-6)

The 5/8" RN-6 (starting with serial number FC 1609200) is arranged so that, when the feed is disengaged, an auxiliary air cylinder operates the brake independent of its normal cam operation. Setting the nuts on the cylinder rod is done with the operating roll on the dwell portion of the cam and the cylinder retracted. With the roll remaining on the dwell portion of the cam, operating the cylinder should move the adjusting nuts a minimum 3/4-inch from the brake lever. Clamp the jam nuts in place.

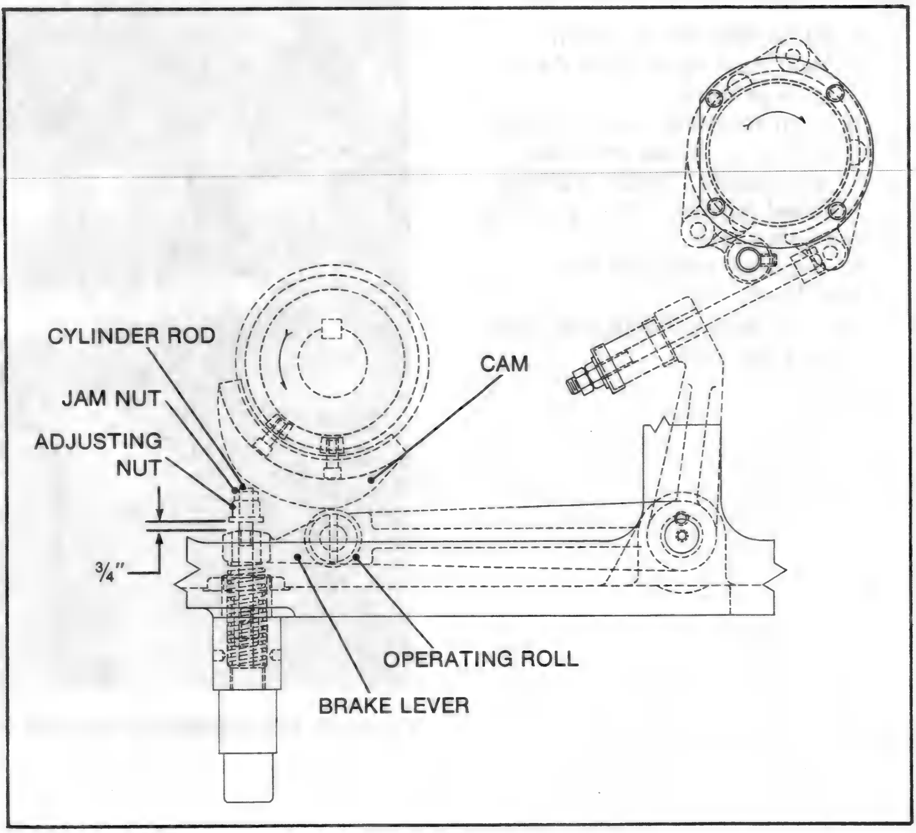

CYLINDER ROD
CAM
JAM NUT
ADJUSTING NUT
3/4"
OPERATING ROLL
BRAKE LEVER

Fig. H-18. Supplemental air cylinder brake.

Ratcheting Style Slip Clutch

Serial numbers for machines with ratcheting style slip clutches. (Fig. H-19) are listed below. This style of clutch does not require resetting.

NOTE: Machines can be converted to the positive releasing ball type slip clutch. Contact National Acme for details.

Machine Size	Serial Number Sequence
1⅝" RB-8	85308 thru 85369
2" RB-8	85308 thru 85369
2⅝" RB-6	84527-A thru 84672-A
2⅝" RB-8	96275 thru 96435
3½" RB-4	83230 thru 83238
3½" RB-6*	94542 thru 94696
3½" RB-8	BM-94001 thru BM-94022
4" RB-6	BA-92085 thru BA-92131
4" RB-8	BM-88001 thru BM-88004
5½" RB-4	B-92078 thru B-92113
6" RB-6	BC-88029 thru BC-88048
7¾" RB-4	88301 thru 88305

*3½" RB-6 machines having serial numbers 94527 thru 94541 have a spring loaded slip clutch. (Fig. H-20)

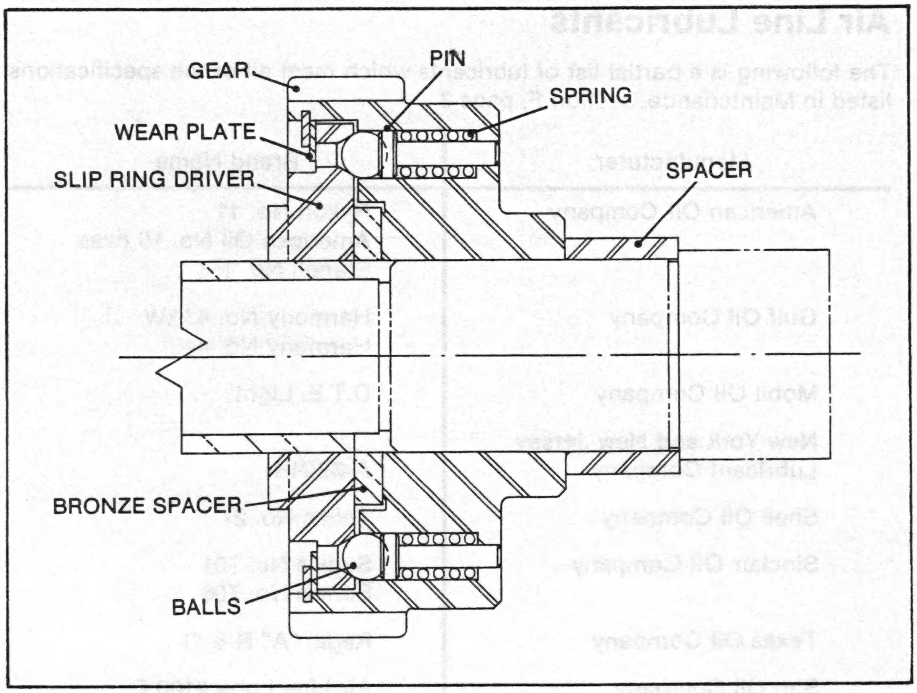

GEAR
PIN
SPRING
WEAR PLATE
SLIP RING DRIVER
SPACER
BRONZE SPACER
BALLS

Fig. H-19. Ratcheting style slip clutch.

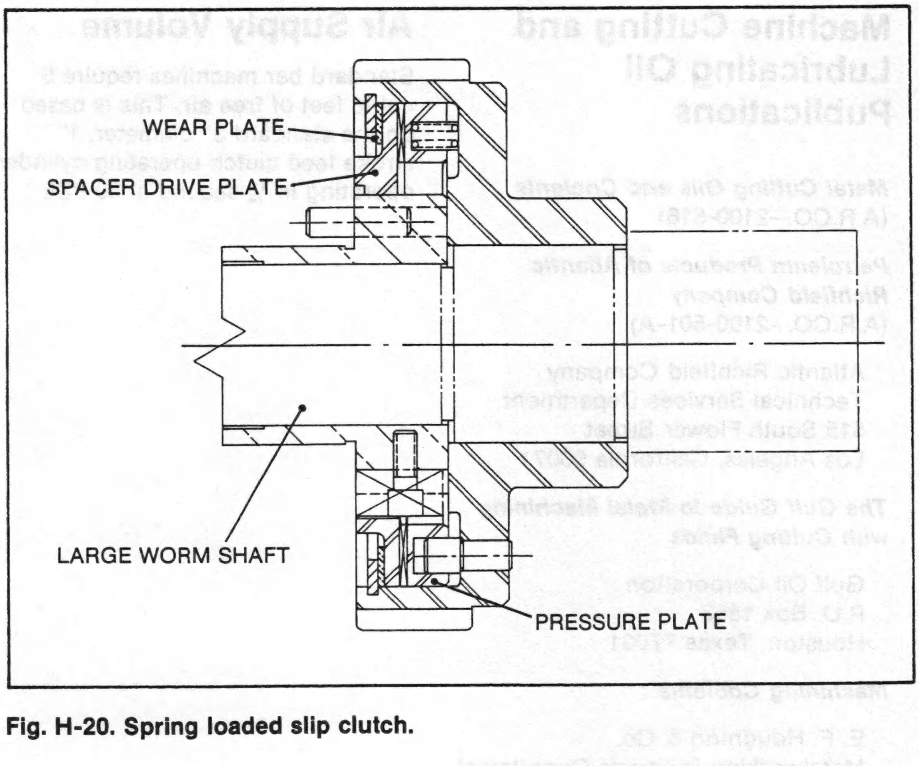

WEAR PLATE
SPACER DRIVE PLATE
LARGE WORM SHAFT
PRESSURE PLATE

Fig. H-20. Spring loaded slip clutch.

Air Line Lubricants

The following is a partial list of lubricants which meet all of the specifications listed in Maintenance, section F, page 3.

Manufacturer	Brand Name
American Oil Company	Rykon No. 11 American Oil No. 15 (was Stanoil No. 15)
Gulf Oil Company	Harmony No. 43AW Harmony No. 44
Mobil Oil Company	D.T.E. Light
New York and New Jersey Lubricant Company	A-88/NR
Shell Oil Company	Tellus No. 27
Sinclair Oil Company	Sunvis No. 701 Sunvis No. 706
Texas Oil Company	Regal "A" R & O
Sun Oil Company	Air Line Lube #100 E

Machine Cutting and Lubricating Oil Publications

Metal Cutting Oils and Coolants
(A.R.CO. -2100-516)

Petroleum Products of Atlantic Richfield Company
(A.R.CO. -2100-501-A)

Atlantic Richfield Company
Technical Services Department
515 South Flower Street
Los Angeles, California 90071

The Gulf Guide to Metal Machining with Cutting Fluids

Gulf Oil Corporation
P.O. Box 1563
Houston, Texas 77001

Machining Coolants

E. F. Houghton & Co.
Metalworking Products Department
Valley Forge Technical Center
VanBuren and Madison Avenues
Norristown, Pennsylvania 19403

Air Supply Volume

Standard bar machines require 6 cubic feet of free air. This is based on the standard 3" diameter, 1" stroke feed clutch operating cylinder operating in ¼ second at 80 PSI.

Electrical Codes and Standards

NOTE: The following sources of reference are included solely as a convenient guide for the users of this manual.

National Fire Protection Association, 470 Atlantic Ave., Boston, Mass. 02210.

Underwriters Laboratories Inc., 207 E. Ohio St., Chicago, Ill. 60611; 1285 Walt Whitman Road, Melville, Long Island, N.Y. 11746; 1655 Scott Blvd., Santa Clara, Calif. 95050; and 333 Pfingsten Rd., Northbrook, Ill. 60062.

American National Standards Institute, 1430 Broadway, New York, N.Y. 10018.

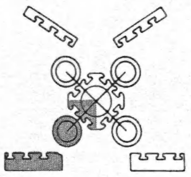
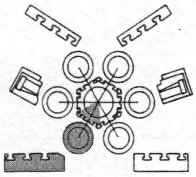
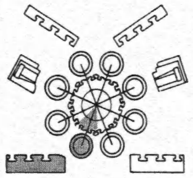
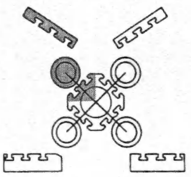
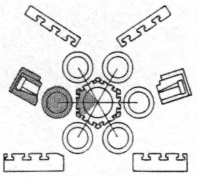
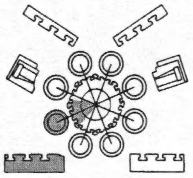
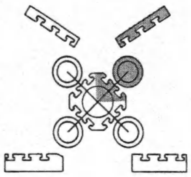
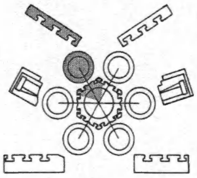
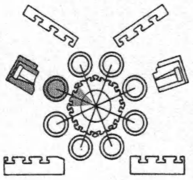
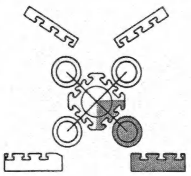
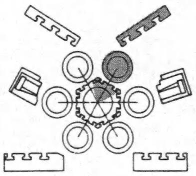
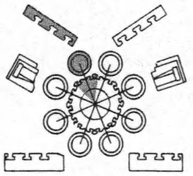
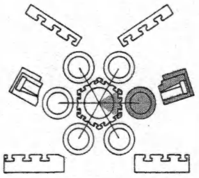
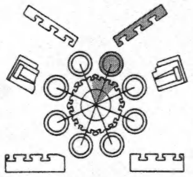
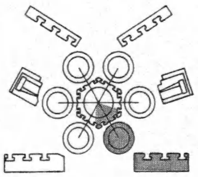
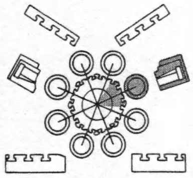
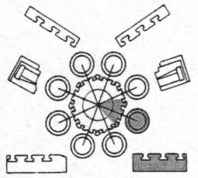
Electronic Industries Association, 2001 Eye St., N.W., Washington, D.C. 20006.

National Electrical Manufacturers Association, 2101 L St. N.W., Washington, D.C. 20037.

National Machine Tool Builders Association, 7901 Westpark Drive, McLean, Va. 22101.

Joint Industrial Council, 7901 Westpark Drive, McLean, Va. 22101.

Spindle Positions

POSITIONS	4-SPINDLE MACHINE	6-SPINDLE MACHINE	8-SPINDLE MACHINE
1st			
2nd			
3rd			
4th			
5th			
6th			
7th			
8th